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RESEARCH ON TEH IMPACT OF VENTURE CAPITAL ON THE OPERATING PERFORMANCE OF STARTUPS

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Research on the Impact of Venture Capital on the Operating Performance of Startups

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I hereby declare that this dissertation is my original work
and it has been written by me in its entirety.
I have duly acknowledged all the sources of information
which have been used in this dissertation.

This dissertation has also not been submitted for any degree
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Abstract

Venture capital can not only realize its own capital appreciation, but also promote the development of startups and boost the development of high-tech industries; therefore, it has obvious positive externalities. With the development of venture capital in China, the impact of venture capital on the operating performance of startups gradually attracts widespread attention.

This paper investigates the impact of venture capital on the operating performance of startups and conducts an in-depth discussion on the problem formulation, empirical relationship, cause and effect analysis, and countermeasure suggestions. The main research contents include:

The first part is the introduction, which analyzes the research background, purpose and significance, research methodology, technical routes, etc., reviews the relevant theories of research objects, the impact of venture capital on operating performance of startups, and relevant literature at home and abroad, and compares and analyzes the development processes of venture capital at home and abroad, in order to lead to the research problems of this paper.

The second part is the empirical analysis, which uses the public data of Chinese GEM listed companies to conduct an empirical analysis of the impact of venture capital on the operating performance of startups and draw relevant conclusions, pointing out that adverse selection is the main reason for the formation of these impact relationships and conducting an in-depth discussion.

The third part is the cause and effect analysis, which mainly elaborates the causes of the market-based selection of risk appetite, information asymmetry, and principal-agent mechanism for adverse selection, and analyzes the adverse selection effects of the

possibility of increasing venture capital for startups, lemon market, and valuation bubble by making use of adverse selection.

The fourth part is the countermeasure analysis, which puts forward countermeasures and recommendations for venture capital, startups, and other participants in the capital market based on the mutual impact between venture capital and operating performance of startups in order to deepen the application value of this paper.

The empirical analysis of this paper demonstrates that the venture capital is negatively correlated with the operating performance of startups due to the adverse selection. This conclusion has positive practical guidance value for the venture capital, startups and other participants in the capital market to strengthen their strategic responses.

Key words: Venture capital Startups Operating performance Impact

Content

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Chapter 1 Introduction

Venture capital can not only realize its own capital appreciation, but also promote the development of startups, boost the development of high-tech industries, accelerate the technological innovation of certain countries and regions, and make up for the insufficient funds for innovative SMEs. It has obvious positive externalities and plays a very active role in prospering economy and society. With the development of venture capital in China, the interconnection and mutual impact between venture capital and the operating performance of startups gradually attract widespread attention and are worth of deep exploration and research.

1.1 Research backgrounds, reasons, purposes and significance

Venture capital (VC), also known as “venture investment”, private equity investment, etc., refers to the investment mode that conducts equity investment in startups, with a view to obtain capital appreciation mainly through equity transfer after the invested startups become matured or relatively mature. Venture capital is an equity-type direct investment with its own distinctive characteristics, and has achieved great success in developed economies such as Europe and the United States and developed areas in China.

1.1.1 Research backgrounds and reasons

China’s economic and social development can be described as a magnificent history. Reform and opening-up have profoundly changed the social relations of China, which has greatly promoted the production of material wealth compared with the past. And the national economy has maintained a rapid growth for many years. At present, China has entered a new stage of development, facing a transformation from an economic growth model of resource consumption, earning foreign exchange through exports investment driving, and extensive development to resource conservation, consumption growth, innovation driving and intensive development. The environment for economic development is increasingly complex. Driven by the evolution of industrial structure, Chinese economy is presenting a trend of switching from old growth drivers to new ones, and forming an innovation drive from quantitative change to qualitative change. The proportion of new growth drivers in the national economy is accelerating, and the scale can make equal to some of the old growth drivers. The increase in the economic contribution of growth drivers stems from a more obvious acceleration trend presented by the scale.

The emergence of a new economy and new growth drivers is inseparable from the venture capital. “Widespread Entrepreneurship and Innovation” has strengthened the concentration effect of capital, projects and talents. According to data from more than 700 Chinese GEM listed companies, more than 50% of these companies were favored by venture capital before IPO. At the same time, venture capital has its own distinctive characteristics:

Firstly, the investment objects are mainly high-tech startups. Compared with traditional enterprises, high-tech enterprises are at the forefront of technological innovation, which may bring revolutionary changes to human production and life. Therefore, they have higher growth potential. Although the traditional commercial banks seeking lower and fixed investment returns are unwilling to get involved, high-tech enterprises have become favored investment objects for venture capital pursuing high profits and having probability of failure. In the United States, more than 70% of venture capital is invested has been put high-tech fields, which has greatly promoted the industrialization of high-tech[①].

Secondly, high risks and high returns exist side by side. In the process of technological innovation and incubation growth, high-tech enterprises need to go through the stages of R&D, experiment, serving and sales. Each of these stages is highly uncertain and likely to fail. Therefore, venture capital has high risks. At the same time, once a high-tech startup succeeds, it can enable venture capital to obtain high returns of several times, dozens of times, or even hundreds of times due to its knowledge-intensive, technology-intensive and innovation-intensive products or services. With the high gains obtained from successful projects to offset the losses of failed projects, venture capital can obtain a higher average return.

Thirdly, provide value-added services for startups. Venture capital not only builds a bridge between capital and high-tech, but also provides

[①] PEdaily.cn.*What is Startup Investment?*. https://pe.pedaily.cn/chuangye.shtml

important funding sources for the cultivation and growth of many promising high-tech startups that are difficult to finance from banks and other channels. It also actively participates in major management activities of invested companies after investment, provides value-added services that cannot be achieved by startups' own resources, assists the invested companies in brand image promotion, continuous financing, governance improvement, risk control, IPO counseling, etc., to facilitate the invested companies to grow bigger and stronger quickly.

Fourth, the investment period is long and the liquidity is relatively small. Venture capital often considers to exit after going through the R&D, production, marketing, sales and other processes of startup projects. Therefore, the investment period is longer, ranging from 3-5 years to 7-10 years. This is different from the repayment of principal and interest, exit on time or transfer of creditor's rights of credit capital.

Fifth, the periodicity and cyclicity of investment. Venture capital emphasizes the potential growth and high profitability of the invested companies. When the invested companies rapidly develop to a certain stage, the equity value of venture capital doubles, and the equity is sold to achieve high capital returns at this time. Hereafter, venture capital can seek new risk projects with the principal and proceeds, pursue new returns, and form a cycle of capital movement. It is exactly because of this special mechanism of venture capital that small and medium-sized innovative enterprises continue to emerge, develop and expand.

As venture capital invested in startups has the characteristics of profit-seeking, periodicity, and failure-tolerance, the mutual impact between venture capital and operating performance of startups is worthy of deep exploration, which in turn leads to issues such as why and how to impact and can be applied to enhance the operation level of venture capital, strengthen the integration of startups and venture capital, and promote the healthy and sustainable development of China's capital market.

This paper takes the GEM listed companies as the research object to carry out the research on the mutual impact of venture capital and operating performance of startups. The main reasons are as follows:

Firstly, venture capital and startups are important components of China's new economy and new growth drivers. The relationship between venture capital and operating performance of startup is a trending topic. The research of this paper will help boost the development of China's new economy represented by high-tech industry. The author has long been concerned about China's new economy, new growth drivers, and the future and destiny of China's economic and social development. Conducting research on the relationship between venture capital and operating performance of startups will help deepen the understanding of the future development of China's new economy.

Specifically, the ever-changing industrial form, labor costs that increase over time, increasingly scarce natural resources, severe environmental

pollution, and dynamic global economic new pattern have all had a major impact on China's economic development. How to realize high-quality economic growth of China is an extremely important and arduous task. The economic development path of developed countries affords us useful experience that when economic development reaches an advanced stage, they establish a development mode driven by technological innovation. Venture capital plays an indispensable role in technological innovation, so it is also positive for technological innovation. Carrying out research on the impact of venture capital on the operating performance of startups will bring about the understanding on the development path of startups with technological innovation as their mission.

Secondly, the IPO is a symbolic time node for the development of startups. Venture capital has a very obvious impact on the operating performance of startups before the IPO. The venture capital may, before the IPO, take all measures to improve the operating performance of startups in order to help the startups sprint to go public, so the operating performance of startups should fully realize its potential. After the IPO, as the goals of venture capital and startup are no longer the same, the role of venture capital may be divergent. One option is to let things take their course. Because after a startup goes public, it needs to accept more regulatory requirements, and the role of venture capital is weakened and inadequate to help the operating performance, so that the operating performance of startups will decline; another option is to continue to contribute to the operating performance

of startups, in order to achieve a high premium exit of venture capital. Therefore, using IPO as a time node to explore the mutual impact between venture capital and operating performance of startups is conducive to deepen the understanding of the subject of this paper.

At the same time, the valuation bubble of venture capital projects currently is a hot topic. Wework, a shared office space project invested by Softbank, flopped before the IPO, and even failed to go public due to the resistance from the capital market. As an investor widely involved in venture capital and the secondary market investment, the author is particularly concerned about the impact of venture capital on the operating performance of startups before IPO, which is also a reason for conducting the research of this paper.

Venture capital makes complicated impact on the operating performance of startups, and its mechanism is worthy of further research and discussion. The mechanism has been researched and investigated from the perspective of classic theories, such as adverse selection hypothesis, monitoring hypothesis, certification hypothesis, and market power hypothesis. It is shown from the current related studies, there has not yet been a consensus on the impact of venture capital on the operating performance of startups. This paper mainly conducts a profound discussion from the perspective of qualitative and empirical analysis in order to draw some meaningful conclusions. For the author, analyzing the reasons is very significant for the career development with investment as the main job.

Fourthly, this paper is themed “the mutual impact between venture capital and operating performance of startups”, with venture capital and startups as two main subjects. At the same time, as the data sources and research objects are mainly from the Chinese GEM listed companies, the third-party participants in the GEM market should also be considered. Such participants mainly include securities underwriters, exchanges and other regulatory authorities, and investors in the primary and secondary markets. In this way, the analysis of the relationship between venture capital and operating performance of startups will not only enlighten venture capital and startups, but also enlighten other participants in the GEM market and the proposal of relevant strategic recommendations will contribute to promoting the healthy and sustainable development of China’s capital market, which is also a wish of the author to carry out the research in this paper.

1.1.2 Research purposes

There is a complex relationship between venture capital and operating performance of startups, which is affected by a combination of various factors. This paper focuses on the mutual impact of venture capital and operating performance of startups, with the main research purposes as the follows:

The first purpose is to make theoretical interpretation and literature review. The academic community has established the theories of adverse selection hypothesis, grandstanding hypothesis, monitoring hypothesis, certification hypothesis, and market power hypothesis to

address the mutual impact of venture capital and operating performance of startups. The predecessors have also conducted profound related researches, and there are a large number of research literatures. In this paper, trace analysis and review are performed on relevant theories and literature. From the theoretical level, the impact relationship and association mechanism between venture capital and operating performance of startups are discussed.

The second purpose is to put forward research hypotheses from the perspective of “the impact of venture capital on the operating performance of startups”. Based on the statistical IPO data of Chinese GEM listed companies, a mathematical model of the impact of venture capital on the operating performance of startups is constructed, relevant hypothesis verification and conclusion analysis are carried out accordingly, and the impact of venture capital on the operating performance of startups is explored from an empirical level.

The third purpose is to analyze the causes and effects of adverse selection in the venture capital process. Venture capital has a negative correlation with the operating performance of startups due to adverse selection in the venture capital process. Then, the causes and effects of adverse selection are analyzed to enhance the understanding of the venture capital market characteristics, such as the possibility of increasing venture capital for startups, lemon market, valuation bubble, moral risks, and threshold issues.

The fourth purpose is to put forward relevant strategic recommendations for venture capital, startups, and other participants in the GEM market based on the results of empirical analysis in order to promote the healthy and sustainable development of China's capital market, deepen the theoretical reference and practical guidance of this paper.

1.1.3 Research significance

This paper takes Chinese GEM as the data source and empirical analysis object to carry out the research on the relationship between venture capital and operating performance of startups. The research significance lies in the following aspects.

First of all, empirical method is adopted to clarify the impact of venture capital on the operating performance of startups, which helps to strengthen the understanding of the impact of venture capital on the operating performance of startups. The operating performance of startups is mainly reflected in profitability, operating ability and solvency. The presence or absence of venture capital will have a certain impact on the operating performance of startups. The empirical analysis and overall description of such impact relationship will help strengthen people's understanding of the role of venture capital. Further, using IPO as a time node to investigate the impact of venture capital on the operating performance of startups can describe the role of venture capital for startups for different purposes in a more profound manner,

which provides a valuable reference for the development of venture capital and the introduction of venture capital into startups.

Secondly, qualitative analysis is applied to explore the causes for the impact of venture capital on the operating performance of startups, which helps to understand the impact mechanism of venture capital on startups, and strengthens the verifications on relevant theories such as adverse selection hypothesis, monitoring hypothesis, certification hypothesis and market power hypothesis. And observation is conducted on some characteristics of startups' choice of venture capital, in order to draw some ideas that can help promote the development of venture capital and startups, and then to guide to solve the realistic problems.

In terms of theoretical research, the researches on the impact of venture capital on the operating performance of startups carried out by western scholars basically take the mainstream hypotheses of adverse selection, monitoring, certification and market power of venture capital as the theoretical basis. The adverse selection hypothesis is mainly to demonstrate from the perspective of information asymmetry that companies with promising development prospects will avoid venture capital, while those with worse performance and poor growth choose venture capital financing to share future risks. The monitoring hypothesis elaborates that by exerting the "screening effect" and "monitoring effect", venture capital plays a supervisory role to startups and provides value-added services to improve the efficiency of enterprises. The certification hypothesis asserts that as it is difficult for

external investors to obtain all information of the companies, lower prices will be offered to their securities, while venture capital with a good reputation is a third-party verification agency that can provide verification information for companies by financial capital and reputation capital, which has an impact on the security pricing of the listing of a company. In the market power hypothesis, venture capital is attractive. By attracting high-quality market partners, including underwriters, institutional investors and securities analysts, to participate in the IPO of target company and improve the valuation of the IPO and secondary market to obtain considerable returns.

However, due to the late start of research on venture capital in China and basing on the different hypotheses, scholars still have disagreements. One of the most apparent examples is that domestic scholars sometimes silently accept the certification hypothesis and the grandstanding hypothesis of venture capital and sometimes make the conclusion that these hypotheses are not suitable for the Chinese market. It is certain that the laws of venture capital in the West have play a very important role in deepening our understanding on venture capital, but the gap between the West and China in the analysis of economic problems must not be blurred. Theoretical verification and analysis of empirical relationships can help understand the application of relevant theories in China’s venture capital market and guide the development of venture capital and startups.

Thirdly, it is of great significance to propose strategies for venture capital, startups, and other capital market participants to promote the

sustainable and healthy development of China's capital market, on basis of the impact of venture capital on the operating performance of startups. Venture capital and startups are important players in China's capital market. In addition, the capital market also consists of other institutions, regulatory authorities and various investors. Based on the impact of venture capital on the operating performance of startups, as well as the mechanism of the impact and cause, some strategic recommendations for venture capital, startups and other participants in the capital market can be formed to promote the development of China's capital market, boost the transformation and upgrading of industrial structure and the flourishing of innovation and startup activities, which has a far-reaching significance for the future development of China's new economy and new growth drivers.

1.2 Research content and methodology

1.2.1 Main research content:

The paper discusses the impact of venture capital on the operating performance of startups in order to obtain a clearer and more accurate judgment of China's venture capital market. Then, the strategies for venture capital, startups, and other capital market participants are proposed. The content structure of the paper is mainly divided into 7 chapters.

Chapter 1 is the introduction. This chapter is the beginning of paper, mainly explaining the research backgrounds, reasons, purposes and

significance, research content, research methodology, technical routes and possible novelties of the paper, which plays a guidance role.

Chapter 2 is about fundamental theories and literature review. It mainly includes concepts related to venture capital and startups, relevant theories on the mutual impact of venture capital and operating performance of startups, and Chinese and foreign literature reviews and evaluations.

Chapter 3 is about the development process of venture capital and research problems in this study. It mainly includes the development history of Chinese and foreign venture capital, as well as the introduction to the research problems, relevant research framework and research design.

Chapter 4 is an empirical analysis of the impact of venture capital on the operating performance of startups. It mainly includes the characterization dimension of the operating performance of startups, regression analysis of the impact of venture capital on operating performance of startups, hypothesis verification and conclusion discussion of the impact of venture capital on operating performance of startups.

Chapter 5 analyzes the causes and effects of adverse selection in the venture capital process. Venture capital has a negative correlation with the operating performance of startups due to adverse selection in the venture capital process. This chapter mainly analyzes the causes and effects of adverse selection: The causes include the market-based

selection of risk appetite, information asymmetry, and principal-agent mechanism for adverse selection, and adverse selection effects mainly elaborate the possibility of increasing venture capital for startups by making use of adverse selection, lemon market, and valuation bubble, moral risks and threshold issues.

Chapter 6 puts forward countermeasures and analysis of the mutual impact between venture capital and operating performance of startups. It is mainly based on the empirical analysis of the impact of venture capital on the operating performance of startups, and combine the causes and effects of adverse selection to propose countermeasure suggestions for venture capital, startups and other participants in the capital market, and deepen the research value of the paper.

Chapter 7 is about research conclusions and prospects. Based on the research in Chapters 1 to 6, the main work and conclusions of the paper are reviewed, and the problems and directions which require further study are pointed out for the paper.

1.2.2 Main research methodology

Economics is a science that guides economic practice and solves practical problems. Literature research, descriptive statistics and econometric analysis, qualitative and comparative analysis are all commonly used in the researches of economics. These methods will be comprehensively applied to carry out research in the paper.

(1) Literature research and summary analysis methods

Literature research is a method of sorting out and reviewing the literature, outcomes and theories of previous studies, and forming a scientific understanding of facts through literature research. Summary analysis is a method of inducing and analyzing specific situations in practice to make them systematic and theoretic. In the paper, literature research is mainly used in the literature review, and summary analysis is mainly used in background analysis and countermeasure analysis.

(2) Descriptive statistical method

Descriptive statistics is a method of data statistics, arrangement, induction and analysis, which can discover the internal laws of numbers in economic matters. Descriptive statistics is the key to empirically analyze the interactive relationship between economic matters, and it helps comprehensively examine the mutual impact between venture capital and operating performance of startups, so as to display the mathematical relationship between venture capital and operating performance of startups from multiple sides and dimensions.

(3) Metrological analysis method

Mathematical models and quantitative analysis are applied to conduct hypothesis verification on the impact of venture capital on the operating performance of startups in the paper, which mainly involves multiple regression analysis with dummy variables, in order to reveal the empirical impact relationship between venture capital and operating performance of startups.

(4) Qualitative analysis and comparative analysis methods

Qualitative analysis method to infer the nature and development trend of things based on the subjective judgment and analysis ability of researchers. Comparative analysis method is to compare objective things so as to realize the essence and law of things and make a correct evaluation. In the paper, qualitative analysis is mainly used in analyzing the causes and effects of adverse selection of the impact of venture capital on the operating performance of startups, and comparative analysis is mainly used in proposing related countermeasure suggestions.

1.3 Technical route and novelties

1.3.1 Technical route

According to the research content and research methodology of the paper, the technical route can be illustrated as follows (Figure 1-1):

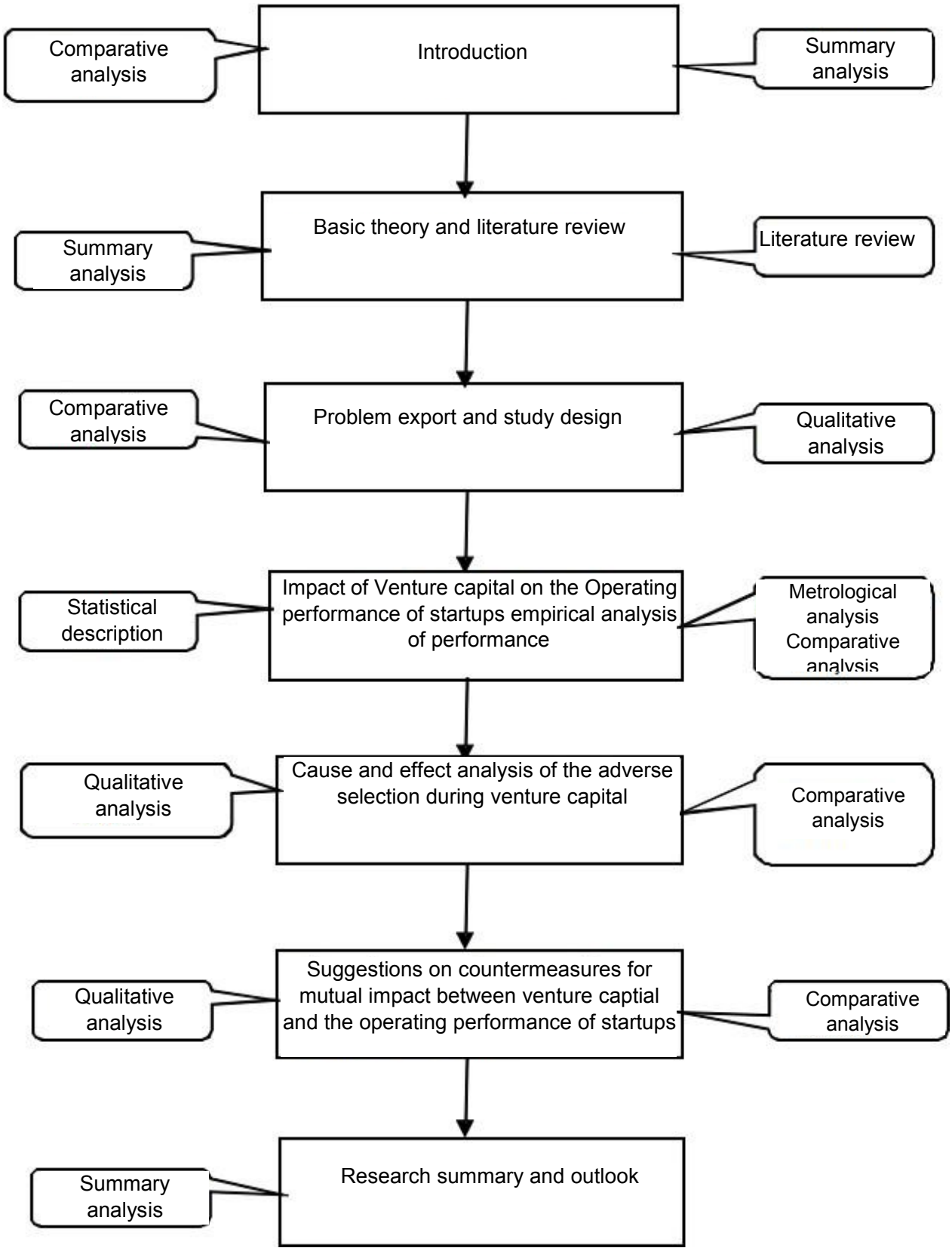

Figure 1-1 Technical route of research

1.3.2 Possible novelties

In the process of research on the relationship between venture capital and operating performance of startups, possible novelties mainly lie in following two aspects:

The first possible novelty lies in the innovation of research content. The paper studies the impact of venture capital on the operating performance of startups, and also deeply discusses the causes and effects of adverse selection in the venture capital process. According to literature research, at present, many studies have addressed “the impact of venture capital on the operating performance of startups” while few studies have explored “the causes and effects of adverse selection”. In this study, the above two are combined, which shows some innovations in the research content.

The second possible novelty lies in the innovation of research value. In relevant research at home and abroad, there are many research literatures that believe that venture capital has a positive impact on the operating performance of startups, and certainly there are research literatures that hold the opposite view. The paper does not hold any predetermined position in the research process, with all depending on data. It is concluded that venture capital is negatively correlated with the operating performance of startups mainly due to the adverse selection, and the countermeasure suggestions that have practical guiding significance for venture capital, startups, and other capital market participants may form a certain innovation of research value.

Chapter 2 Fundamental Theories and Literature Review

Venture capital and startups follow each other and have close ties. The impact between venture capital and operating performance of startups has long been widely concerned by academic community in China and abroad, and there are many theories formed, a lot of related research literatures and different academic views. This chapter mainly explains the related theories, related research literature and research results of venture capital, startups, and the impact of venture capital on operating performance of startups through literature review.

2.1 Venture capital and startups

2.1.1 About venture capital

From the concept perspective of venture capital, the venture capital in broad sense generally refers to all investments with high risks and high potential returns; the venture capital in narrow sense refers to the investment in production and operation of technology-intensive products based on high-tech. From the perspective of investment behavior, venture capital refers to an investment process that invests capital in the research and development field of high-tech and its products having the risk of failure to obtain high capital returns.

At present, venture capital is becoming an important part of China's multi-level financial system, which is essential to the technological innovation and the development of high-tech industries.

(1) The meaning of venture capital

Venture capital is mainly equity capital provided to unlisted startups. A complete venture capital process includes four steps: fundraising, investment, management, and exit.

The fundraising step refers to the fundraising by fund managers from qualified investors such as institutions and individuals, mainly involving preparations, core legal documents, roadshows and fund establishment. In this process, investors are facing both high expected return and a loss of principal, so it is a “venture capital”. The investment step refers to that the venture fund managers (venture investors) invest the raised funds into the startups to obtain the equity of the startups, in order to realize capital appreciation after the rapid growth of the startups, involving project search, project evaluation, due diligence and investment plan design, etc.; due to the characteristics of fast growth and high income, high-tech industry has become the target of most venture funds. This process reflects the characteristics of the introduction of venture capital by the entrepreneurs to start businesses, so it is a kind of “venture capital”. The management step refers to that after venture capital is invested in startups in exchange for shares, venture fund managers provide value-added services to help startups improve financial, strategic, marketing and other management levels, and strengthen investment risk control in order to prompt startups to grow bigger and stronger. The exit step refers to that the venture capital exits the startups after a certain period of time to realize value-added investment; instead of controlling the operating rights of the enterprise, the purpose of venture capital is to transfer out the equity after the rapid

growth of the invested enterprise to obtain high returns. The exit methods of venture capital include IPO exit, mergers and acquisitions, equity repurchase, and liquidation exit.

The venture capital process can be deemed as a process of capital movement. In this process, investors obtain capital appreciation income, risk fund managers obtain management income and share the capital appreciation income of investors, and startup entrepreneurs quickly get bigger and stronger, thus bringing about economic and social benefits such as high-tech industry growth, technological progress, employment, and taxation. Therefore, venture capital has created a new economic development model, stimulated the vitality of economic development, and has great benefits for economic and social development, which is a booster for the economic and social development of a country and region.

(2) The role of venture capital

It can not only realize its own capital appreciation, but also promote the development of startups, boost the development of high-tech industries, accelerate the technological innovation of certain countries and regions, and make up for the insufficient funds for innovative SMEs. It has obvious positive externalities and plays a very active role in prospering economy and society.

Firstly, promote the development of startups. Venture capital not only provides capital input to high-tech and high-risk startups, but also provides a variety of value-added services after investment to help

startups achieve rapid growth. While achieving its own investment and value-added goals, it objectively promotes the development of startups. At the same time, venture capital exits after the growth of a single startup, and seeks new startup projects in the market, continues to invest to promote the development of new startups, which forms a circular movement of capital and becomes a capital partner that always goes with startup activities.

Secondly, foster the prosperity of high-tech industries. From successful R&D to real industrialization, high-tech needs to go through many processes including product testing, production and marketing, and may face the risk of failure at any process. The intervention of venture capital provides capital and value-added services, accelerates the transformation of high-tech achievements, and has become a catalyst for the industrialization of high-tech achievements. In addition, the concentration of venture capital also attracts a large number of entrepreneurs to form a multi-level industrial cluster led by large high-tech enterprises and supplemented by many small and medium-sized enterprises. The world-renowned high-tech industrial clusters such as Silicon Valley in the United States, Bangalore in India, and Hsinchu Science Park in Taiwan cannot develop without the strong support of venture capital.

Thirdly, accelerate technological innovation. Venture capital is committed to investing in high-tech companies at start-up stage. For long-term development, enterprises must continually carry out technological innovation. However, capital investment in enterprises at

start-up stage rarely have income, traditional banks and other financial companies are reluctant to invest for risk reasons. The provision of loans and the introduction of venture capital have promoted the development of technological innovation. The technological innovation process is confronted with huge technical risks and market risks, and it is difficult for entrepreneurs themselves to resist the risks. Venture capital is mainly invested in the form of equity. After becoming a shareholder of the enterprise, it shares the risks with the enterprise. Even if the technological innovation of enterprise fails or the operation is poor, the repayment of principal is not required. Instead of simply investing in the technological innovation of an enterprise, venture capital will invest in multiple technological innovation projects at different stages of development at the same time. Although diversified investment does not always succeed, it reduces the risk of high-tech innovation to a certain extent and promotes the technological progress of the entire society.

Fourthly, break the “difficult financing” dilemma of innovative SMEs. The core value of innovative SMEs lies in innovation, so there are full of uncertainty in few fixed assets and future earnings. Credit capital that pursues stable returns and dislikes risk will seldom intervene, while venture capital that pursues excess profits and prefers risk just makes up for this blind spot in the financial market. If the traditional banking industry despises the poor and curries favor with the rich and likes making things even better, venture capital is undoubtedly the opposite. It is not afraid of risks and prefers to provide timely help. Therefore, the

deluge of venture capital can gradually eliminate the difficulty and costly financing for innovative SMEs.

Because venture capital has the significant external role mentioned above, many countries and regions regard promoting startup investment as an effective means for expanding new economy, promoting technological innovation and improving regional competitiveness, and encourages, guides, and facilitates the development of venture capital.

2.1.2 About startups

Entrepreneurship is a process of discovering and capturing opportunities to create novel products, services or realize the potential value. The startups refer to innovative and pioneering enterprises which simultaneously contain high growth and high risks in the start-up stage. Entrepreneurship is closely related to creativity and innovation, and startups consist of an important part of innovation activities.

(1) Creativity, innovation and startup

Creativity refers to novel and creative ideas different from ordinary solutions, which is obtained mainly through brainstorming and reverse thinking. Innovation is the act of improving or creating new things, methods, elements, paths, environments, with certain beneficial effects obtained. Generally speaking, innovative activities are accompanied by a large number of creative ideas.

Startup refers to the process by which entrepreneurs optimize and integrate the resources they own or the resources that can be owned by them through the efforts to create greater economic or social value. Startup is inseparable from creativity and innovation. Creativity mainly generates ideas first, innovation is the act of putting ideas into practice, and startup is the process of commercializing innovative acts.

Venture capital focuses on the entire process of startups and can participate in the creation stage, which is generally called a seed fund. The initial innovation stage can be called an angel round. After it has a commercial structure, it is collectively called venture capital. After growing to relatively mature, it is called private equity investment, which is further divided into A round, B round, C round, C+ round, D round, etc. Generally speaking, it corresponds to the life cycle of an enterprise, but limited to the time before IPO. After a startup enters a mature period (usually marked by IPO), it is generally no longer called a startup, and its financing activities are not considered as absorbing venture capital.

(2) Startups and their characteristics

It is generally believed that enterprises that have certain innovation activities and are in the stage of entrepreneurship are called startups. Entrepreneurs create market entities by recognition of entrepreneurial opportunities to form the startups. The recognition process of entrepreneurial opportunities includes creation, discovery and identification. Identification mainly occurs in traditional economic field, creation mainly in new economic field, and discovery mainly in the

transition from the traditional economy to the new economic field. Entrepreneurs and startups should have a certain entrepreneurial spirit.

The characteristics of startups mainly consist of the following.

Firstly, have a certain entrepreneurial spirit and innovative ability. Entrepreneurship refers to the comprehensive ability of the organization, establishment, operation and management of market subjects. It is an important and special intangible production factor. Entrepreneurial spirit becomes the key to determine whether the organization will succeed or fail in the market competition. Entrepreneurship generally manifests itself in many aspects such as innovation. It can be said that innovation is the soul of entrepreneurship, and the startups must be accompanied by certain innovation activities and have certain innovative capabilities. In addition, entrepreneurship also includes adventure, cooperation, dedication, learning, perseverance and integrity, which are also critical to the success of a startup.

Secondly, survival is the primary task of startups. The primary task of a startup is to survive in the market and make consumers recognize and accept its products. Only in this way can an enterprise continue to create value for customers and continue to grow and develop. Therefore, in the startup stage, “survival” should always be the first priority, and everything should be operated around survival. All practices that endanger survival must be avoided.

Thirdly, the startups must be customer-oriented. Customer orientation is one of the essential characteristics of startups. From the perspective

of the realization approach of startup, it is usually realized based on a deep understanding of customer needs and the unique value created for customers. Without this, the existence value of enterprise will be all gone and startup will be bound to fail.

Fourthly, the startups adhere to opportunity orientation. Without clinging to the constraints of current resource conditions, the startups seek opportunities by combining different resources to utilize and develop opportunities and create value. Therefore, startups tend to respond quickly upon discovering opportunities, rather than developing and utilizing opportunities in a planned, organized and well-positioned manner. In this case, the actions of enterprise are often driven by opportunities.

Fifthly, free cash flow is created mainly by relying on its own funds. Cash flow is like human blood which maintains human life in a smooth circulation, and good cash flow is the basic condition for the enterprises to survive. Therefore, startups must make every endeavor to increase operating income and expenses, accelerate capital turnover, and control the development pace. They mainly rely on their own funds to create free cash flow, thereby providing a basic guarantee for the survival of enterprises.

Sixthly, an efficient startup team can be easily formed. In the early days of establishment, the organization of most startups is not perfect, mainly aiming to “complete tasks”. It often shows a “highly ordered” state, and is easy to form an efficient startup team. As everyone,

especially the members of the startup team, knows his/her goals and strives to work at full stretch. In the process, no one will fuss about the gains or losses, the power, or clearly divide the responsibilities. There are only roles and no difference in positions. The team features high cohesion, high execution and high motivation.

Due to the above-mentioned characteristics of startups, they are particularly suitable for the intervention of equity capital, especially venture capital. The main reasons are: Firstly, a certain entrepreneurial spirit and innovative ability, customer orientation, and opportunity orientation are conducive to guaranteeing the rapid growth of enterprises, so that venture capital may obtain high return on investment; secondly, as the startups have insufficient assets for mortgage and poor credit (not necessarily due to default, but due to the weak credit, lack of credit history, etc.), mainly relying on their own funds to create free cash flow, once financing is needed, the loan capital is difficult to intervene, but venture capital does not require mortgage, which is suitable for investment; thirdly, the startups often have efficient teams, which is easy to form a vibrant and prosperous corporate culture. Successes are achieved by excellent people, investment is also about investing people and teams. A good team can improve the safety margin of risk capital.

(3) Operating performance of startups

Operating performance is a relatively broad concept. From the management perspective, operating performance is the result expected

by the organization, which can be considered a combination of process and result. According to the definition of foreign scholars, “performance is the achievements and results of work, as such achievements and results are closely related to the strategic goals, customer satisfaction and financial returns of the enterprise”.(Zhang,2006) From the economics perspective, operating performance can be described as the relationship between economic input and output, which is the maximum output of the enterprise under limited resources or the minimum input under fixed output. Its specific representation refers to the completion of relevant indicators of the enterprise.

In relevant literature, operating performance is generally measured from the dimensions of profitability, solvency, operating ability, and growth ability. In terms of the operating performance of startups, the in-depth investigations are not conducted in some enterprises that are struggling due to the extremely unstable growth ability of startups, the large annual changes in relevant indicators including operating income growth rate, total asset growth rate, operating profit growth rate, net profit growth rate and net asset growth rate, and the great differences between industries.

In this paper, in terms of profitability, the return on equity (ROE) and the return on total assets (ROA) are selected to represent the profitability of startups; in terms of solvency, the current ratio (CR) and the quick ratio (QR) are selected; in terms of operating capabilities, the inventory turnover (I_TURNOVER) and the total asset turnover (TAT) are selected. The interpretations of relevant indicators are as follows.

ROE = net profit/average balance of shareholders' equity. This indicator reflects the level of returns of shareholders' equity and is used to measure the efficiency of an enterprise to use its own capital. The higher the indicator value, the higher the return on investment. This indicator reflects the ability of equity capital to obtain net proceeds.

ROA = (total profit + interest expense)/average total assets. This indicator analyzes the profitability of an enterprise based on investment returns, and is the ratio between the investment returns and total investment of an enterprise. The investment returns of an enterprise refer to the sum of the profit before paying the interest and the income tax, with the total investment as the average total assets of the current period.

CR = current assets/current liabilities, which is used to measure the ability of an enterprise to convert its current assets to cash for repayment of liabilities before the short-term debt expires. The higher the CR, the stronger the liquidity of an enterprise's assets and the stronger the repayment ability of short-term debt. However, a great ratio indicates that the occupancy of current assets is large, which will affect the operating capital turnover efficiency and profitability. Generally, a reasonable minimum CR should be 2.

QR = quick assets/current liabilities. Quick assets are the balance of the current assets minus inventory and prepaid expenses, mainly including cash, short-term investment, bills receivable, accounts

receivable and other items, and quick assets = current assets - inventory.

I_TURNOVER = cost of sales/average inventory balance, which is a comprehensive indicator to measure and evaluate the management efficiency of various processes including the purchase of raw materials, production, sales recovery, etc. The faster the inventory turnover (that is, the greater the I_TURNOVER or the number of inventory turnover and the shorter the inventory turnover days), the lower the inventory occupancy level and the stronger the liquidity, the faster the conversion of inventory into cash or accounts receivable, which will enhance the short-term solvency and profitability of the enterprise.

TAT = total sales revenue/total average assets, which is an important indicator to comprehensively evaluate the operating quality and utilization efficiency of all assets of an enterprise, and reflects the overall asset operating capability of the enterprise. Generally speaking, the more the number of asset turnovers or the shorter the turnover days, which indicates that its turnover speed is faster and the operating capability is stronger.

2.2 Theoretical hypotheses for the impact of venture capital on the operating performance of startups

Internationally, many theories or hypotheses about the mutual impact between venture capital and operating performance of startups have been formed during the long-term development venture capital, and

large disputes exist. The relevant theories or hypotheses are explained below.

2.2.1 Adverse selection hypothesis

The adverse selection hypothesis of venture capital is based on the theory of adverse selection in information economics. Akerlof (1970) was a pioneer in the school of information economics. His thesis *The Markets for "Lemons": Quality Uncertainty and The Market Mechanism* is an economics publication that has an important position in the development history of Western economics. At that time, in the markets for lemons in the US, sellers usually chose to hide the quality information of the goods. Akerlof believed that it would produce adverse selection, cause the defective products to expel the superior products in the market, and eventually lead to the perish of the markets for lemon. The law of adverse selection is universal, which is of positive significance in economic science. Scholars in later ages therefore recognized the existence of asymmetric information.(Wang & Liu,2002) Based on the theory of adverse selection, Amit, Glosten, and Muller believed that startups with better operating conditions in actual production do not need to accept venture capital as financing through other means may be more cost-effective and beneficial. They proposed the "Adverse Selection Problem" in 1990. The principal-agent relationship exists between venture capital and capital managers, and information asymmetry is a common phenomenon in such relationship. Based on this, the problems of adverse selection and moral hazard similar to the lemon market mentioned above will generate between

venture capital and startups. In order to better develop productivity, Amit, Glosten, and Muller (1990) believed that the “intervention” of venture capital is unfavorable, and enterprises with capabilities and potential can obtain funds by debt financing or other forms. Under such circumstances, the adverse selection problem may entangle the venture capital industry in tragic situation where it may be conquered by those startups with worse performance and worrying development, causing the immature venture capital institutions to suffer disasters together.

2.2.2 Grandstanding hypothesis

Since the 1980s, the discussion on venture capital has been continuously deepened along with the establishment of venture capital theory. Among them, Gompers and Lemer (1995) found through research that more than 80% of venture capital institutions are limited partnerships with limited duration of funds; financial pressures faced by venture capitalists are much greater than we know, so they are usually reluctant to hold shares in startups during their tenures.Subsequently, Gompers (1996) injected new contents into his discovery. He noticed some immature traits of young venture capitalists and proposed the grandstanding hypothesis. This proposition vividly portrays the process of young venture capitalists’ pushing immature startups to market as soon as possible under the dual pressures of capital recovery and capital appreciation after the 1990s. The hypothesis emphasizes the impact of startup IPO on the reputation of venture capital, but this has exacerbated the trend of higher IPO underpricing rates for venture

capital-backed companies, which increases the incentives of high IPO underpricing for startups. For the post-IPO business of startups, this may result in continuous deterioration of performance. Excellent enterprises would rather choose financing methods of other industries or with fierce competition than choose venture capital. In the end, only inferior enterprises will choose venture capital to share risks.(Zhou & Song,2012) In conclusion, Gompers' analysis is no different from that of Amit, Glosten, and Muller. Because of this, the grandstanding hypothesis is considered a special case of the adverse selection hypothesis. If we extend the horizon of history and judge the background of these two hypotheses, it can be found that the difference between them is extremely significant. When venture capital screens startups, due to asymmetric information, it is often considered to invest in relatively inferior startups. This is the adverse selection hypothesis. But when the funds of venture capital are implemented, the adverse selection hypothesis is no longer suitable. Young venture capitalists can easily be under the various financial pressures of investment, and treats promoting immature enterprises to the capital market as soon as possible as the principle of principal recovery and capital appreciation. On this account, excellent startups defend that they don't need venture capital, and only inferior enterprises will attach importance to venture capital. These "reversals" remind us that the researches made by grandstanding hypothesis in the field of venture capital should not be overlooked.

2.2.3 Monitoring hypothesis

Barry, Muscarella, Peavey and Vetsuypens (1994) pioneered the “Monitoring Hypothesis”.The theory was later supplemented by Chemmanur and Loutskina (1999) and other scholars to continuously develop and improve, they believed that venture capital can play a monitoring effect on startups.(Wu,2017) At the same time, the scholars have their own focuses and give different explanations. Barry et al. used the coalition of high-reputation underwriters for reducing the IPO underpricing rate to illustrate the improvement of venture capital’s supervision on enterprises. At the same time, they considered the position of venture capital in the board of directors as the basis for venture capital to strengthen enterprise supervision. Chemmanur found that it is normal for enterprises to repeatedly hesitate about and measure the IPO timing, and venture capital institutions generally have a special advantage in information about the listing timing of an enterprise. This advantage tends to be the key to successful listing of enterprises in domestic or overseas capital markets. For this reason, startups choose to cooperate with venture capital which will provide “value-added services” of IPO for them. Subsequently, scholars took a giant stride in the theoretical research of the “monitoring hypothesis”. From the chronological order, Chemmanur and Loutskina (2006) split the “supervisory effect” into two parts, with one part as the “screening effect” and the other as the “monitoring effect”.(Cheng,2013) Both are essentially “supervisory effect” in the broad sense, and have same directions of action. However, the “screening effect” is the instant “supervisory effect” before venture capital, and the “monitoring effect” is

the sluggish “supervisory effect” after venture capital. Their research findings lead to such a problem: To what extent can this “supervisory effect” of venture capital be applied to countries other than European countries and America? Whether this “supervisory effect” of venture capital depends on the screening function before venture capital, or on the regulatory function after venture capital. In the researches for seeking answers to these problems, scholars in later ages have also tried to clarify the scope of application of the theory and their main differences through empirical research and other methods.

2.2.4 Certification hypothesis

The traditional corporate finance theory has made a very profound discussion from the perspective of information asymmetry on the motivation to prevent the leakage of news that has an adverse impact on the listing of companies. There is no doubt that external investors are difficult to grasp all the information of listed companies. If some critical bad information is hidden inside the companies, such information can affect the security prices and even directly determine the success or failure of IPO. The situation of information asymmetry will hinder the decision-making of investors in the market, and the valuation of newly listed companies in the capital market is generally low. Listed companies are often powerless to such lower security prices. With this as an entry point, Megginson and Weiss (1991) pioneered the certification hypothesis to fully affirm the role of venture capital in startup IPO. They pointed out that venture capital with a good reputation plays a “certification role” between the capital market and

listed companies, and the security prices that affect startup IPO are more frequent. In this way, scholars have introduced the idea of “certification” into venture capital theory, conducted tentative research on the impact of startup IPO, and carefully considered the role of venture capital in it. The certification hypothesis pays more attention to the performance of IPO of venture capital-backed enterprises than the grandstanding hypothesis and monitoring hypothesis do. This is a major leap forward in the development of venture capital theory, which further widens the boundaries of venture capital theory in explaining actual economic problems.

2.2.5 Market power hypothesis

For any enterprise, negotiation, signing and cooperation with venture capital can be a “systematic project”. Similarly, it is impossible to consider only the impact of venture capital on the IPO underpricing rate and ignore other aspects. Therefore, the problem of “certification hypothesis” lies in that its research scope seems too narrow. For example, if the capital market is not satisfied with the information about listed companies released through venture capital, the certification role may not occur. In particular, the situation in the capital market is changing rapidly, and the valuation of listed companies must depend on various factors in the capital market. Therefore, it requires us to fully discuss the impact of venture capital on the startup IPO. Based on the certification hypothesis, Chemmanur and Loulskina (2006) basically put forward the market power hypothesis through further analysis and research. This is another theoretical contribution of scholars following

the “certification hypothesis” in the field of venture capital’s impact on startup IPO. The main points of the theory include: Venture capital can draw on its own experience and advantages to attract outstanding securities underwriters and institutional investors to take part in the IPO process of the companies it invests in, or invite securities analysts to do some publicity on the IPO of listed companies. Listed companies can benefit from the guidance provided by such high-quality participants. Specifically, the gap of valuation in the dynamic game between listed companies and the capital market will narrow. Certainly, this can also bring greater benefits to venture capital. In terms of research method, the “market power hypothesis” is a continuation of the “certification hypothesis”. It chooses the “friend circle” of venture capital as the starting point to study the effect of the “good friends” of venture capital on startup IPO. Undoubtedly, the “market power hypothesis” shifts the research on the impact of venture capital on startup IPO from reducing the improper valuation caused by information asymmetry to the valuation improvement brought by the demonstration of high-quality participant, achieving new breakthrough in theoretical research.

2.2.6 Supervisory mechanism effect

After the mid-1970s, Jensen and Meckling (1976) put forward the idea of venture capital that focuses on the supervision of enterprise management by venture capital, reflecting that the academic community began to pay more attention to the impact of venture capital on internal governance of enterprise. Fama and Jensen (1983) also believed that venture capital realizes the regulation by assigning

directors to enterprises. Their idea portrays that value-added services brought by venture capital have now been extended to the optimization and internal supervision of enterprise management. And it is highlighted by the regulatory mechanism of venture capital. Gompers (1995), Cotter and Peck (2001), Renneboog and Simons (2005) all believed venture capital is capable of improving the internal governance of companies, and this positive impact mainly comes from the effective supervision and management of the directors which venture capital brings to the target companies. Katz (2009) and Givoly (2010) point out that the effect of strengthening enterprise governance through venture capital is very significant. This conclusion can be corroborated by the fact that the monitoring mechanism of venture capital reduces the earnings management behavior of target companies. Other scholars who support the internal governance of enterprise by venture capital think that, venture capital can play an active role in impacting the enterprise governance structure by optimizing the structure of the board of directors and increasing the ratio of independent directors and professional directors.(Li,2014)

2.2.7 Incentive mechanism effect

In the enterprises where ownership and power of operation are separated from each other, there is a big problem that it is difficult for companies to implement the optimal high-salary incentive system according to the efforts of the managers in the case of information asymmetry. However, by linking the compensations of executives to the operating performance of enterprises, Pareto improvement can be

easily achieved. It is the core content of the incentive mechanism put forward by Jensen et al. (1990). It achieves the consistency between shareholders and managers in terms of goals. It can be seen that this theory describes the incentive mechanism as a very important force to improve enterprise governance. Thereby, the issue of incentive mechanism for venture capital arises. Obviously, the introduction of venture capital contributes to forming a good incentive mechanism, which in turn may have a positive effect on startups.(Peng,2014)

2.3 Literature review on the mutual impact between venture capital and operating performance of startups

In addition to the above theoretical hypothesis, there is a plenty of researches on the impact of venture capital on operating performance of startups in China and abroad, which forms an important support for the research in this paper.

2.3.1 Review of relevant literature

(1) In general, the studies of Chinese scholars generally support the adverse selection hypothesis of venture capital. For example, Zhang Lingyu (2006) set up two control groups for companies supported by venture capital and companies without the support of venture capital, and used comparative analysis to investigate the underpricing levels and underwriting rates of IPOs of startups. But the result is different from the assumption. The underpricing and underwriting rate of companies supported by venture capital are actually higher, which is basically due to the poor quality of venture capital.Zhang Feng (2009)

emphasized that the adverse selection effect of venture capital exists in SMEs board market of China. 256 listed companies on the SMEs board from June 25, 2004 to June 30, 2008 were selected as the research object to establish a mean comparison and multiple regression analysis model, and explain the mechanism by which venture capital affects the IPO of startups. Li Yao and Zhang Ziwei (2011) focused on private equity investment funds and angel investments, which also studies the level of underpricing during IPO and selects samples of companies listed on GEM before 2011. The study found that companies invested by private equity funds had higher levels of underpricing during IPO, and adverse selection was one of the important reasons for such situation. We can see from this perspective that the hypothesis of adverse selection of venture capital is suitable for Chinese companies. Some scholars concentrate on the financial status of startups and study whether the adverse selection hypothesis of venture capital exists from the perspective of ROA, ROE and business profit rate. Song Fangxiu and Li Chenchen (2014) selected GEM listed companies as the research object. And the research found that: Compared with companies without the support of venture capital, companies supported by venture capital have worse financial performance before IPO. Poor financial performance often means that companies have poor capabilities, and normally it is difficult to attract attention from investors. Therefore, this also supports the hypothesis of adverse selection of venture capital.

(2) According to the differences in the analysis conclusions of the grandstanding hypothesis, Chinese scholars can be roughly divided into the following two categories: Among the scholars with positive attitude, Chen Gongmeng, Yu Xin and Kou Xianghe (2011) adopted multiple linear regression method for investigating the “three places and four boards” (Shenzhen SME Board, Hong Kong Main Board, New York and NASDAQ) to compare the adjusted return in the first day of listed companies with or without venture capital support, and found that the grandstanding hypothesis of venture capital exists objectively, especially among newly established venture capital institutions whose supported companies obviously have a shorter listing cycle. At the same time, combined with the factors of the listing location, the above researches further found that the companies with venture capital holdings listed on the Shenzhen SME Board and the Hong Kong Main Board have a significantly higher discount rate during IPO than those listed on the same board without venture capital support. However, under the effect of the grandstanding hypothesis of venture capital, the listing of company is indeed conducted earlier, which in turn will further increase the discount rate of the company at the time of IPO.

Among other scholars with reservations, Song Fangxiu and Li Chenchen (2014) conducted empirical research by employing the cross-sectional multiple linear regression method based on ROA, ROE and other financial indicators. Their research mentioned the adverse selection of venture capital in the GEM market. Because the performance of companies with the supported of venture capital before

listing is worse than that of companies without the support of venture capital, and the discount rate of companies with the supported of venture capital during IPO is actually higher. However, they believe that the role of the reputation variable of venture capital is relatively neutral, and it cannot explain that the reputation effect is significant. This certainly does not imply that the grandstanding hypothesis fails or does not exist objectively, and the corresponding tests can be carried out by adjusting measurement methods, variable design and data selection.

(3) Western scholars almost unanimously give a positive answer to the supervision role of venture capital. Bloom et al. (2009) investigated the situations of more than 4,000 manufacturing companies in the United States, Europe and Asia and found that the performances of companies supported by venture capitals significantly superior to other companies, and this positive effect on performance mainly comes from the improvement of governance of the supported companies. Croce et al. (2013) confirmed that there is a “time effect” on the positive impact of venture capital in European high-tech companies. Only when high-tech companies receive their first round of investment will venture capital have a significantly positive effect. While the productivity of high-tech companies invested by non-venture capital institutions does not show a sudden and violent increase, but a significant growth advantage appears after the first round of VC investment. This conclusion can be used to support the “monitoring effect” of venture capital. The empirical research of Chemmanur and Krishnan (2011) clearly indicates the “screening effect” and “monitoring effect” of venture capital. The

longitudinal research database of the US Census Bureau was used and the endogenous switching regression model, regression discontinuity, PSM and other research methods were adopted to carry out the empirical testing for the TFP of target companies before, during, and after venture capital support. In terms of the effect produced, venture capital is related to the total factor productivity of target companies, and the reputation of venture capital will also directly affect the magnitude of such effect. More importantly, this effect is not restricted before, during and after the event, and runs through the entire process of venture capital. This phenomenon occurs in manufacturing companies (especially between 1972 and 2000). In this way, the target companies develop through the continuous assistance of venture capital, which shows the “screening effect” and “monitoring effect” of venture capital.

In addition to empirical analysis of venture capital by foreign scholars, for a period of time, Chinese scholars have also made some preliminary attempts to verify the monitoring hypothesis of venture capital. However, we conclude from the results that the monitoring hypothesis is not directly reflected in these researches. For example, Tan Yi (2009), Jin Ming and Wang Juan (2010) specialized in the research of the companies listed on SME board of Shenzhen Stock Exchange, and found that venture capital has not improved the performance of the invested companies. Venture capital can even hinder the operating performance, excess returns or improvement in governance of the invested companies in some places. Deng Yaogang (2010) set his sights on the Chinese GEM market. Among the 48 listed

companies funded by venture capital, neither the amount of venture capital, nor the holding time and the number of venture capital has significant impact on the IPO P/E ratio for the companies. However, it can be seen after careful study that the above empirical researches of Chinese scholars are based on the investigation of the stock price performance of the invested company at the time of (after) listing and the operating performance after the listing, and have not reached to the complete interactive relationship of venture capital and startups. They viewed post-listing impact as a possible trend, deviating from what Chemmanur and Loutskina (2006) called the “supervisory effect” consisting of both before and after the listing. Therefore, although these researches find the reverse “monitoring effect” of venture capital on startups, their importance is very limited. Moreover, these researches are not enough to explain whether this impact is due to the beforehand inefficiency of the invested companies or the subsequent weak supervision of venture capital. Attention should also be paid to how more GEM listed companies understand venture capital, and whether the “supervisory effect” in broad sense has occurred.

(4) In the empirical analysis on the role of certification, Megginson and Weiss tested 640 companies listed in the United States between 1983 and 1987. The conclusion is divided into two following aspects: Firstly, the companies with venture capital have lower underpricing rates and stock underwriting rates than companies without venture capital at the time of IPO; secondly, the average market share ratio of lead underwriters of companies with venture capital is higher than that of

companies without venture capital at the time of IPO. To sum up, venture capital can effectively break the information asymmetry between target companies and capital markets with its own good reputation. The companies supported venture capital have such an advantage at the time of the IPO that they can reduce the offering costs and increase the average market share of the lead underwriters under the certification of venture capital.

Judging from the empirical literature of a large number of Chinese scholars on the role of venture capital certification, there are some arguments. One party believes that venture capital plays the certification role, while the other party holds a critical attitude and believes that the certification role of venture capital is not significant. Chen Jianli (2012) investigated many companies listed on the GEM based on the relationship between venture capital and capital markets. The biggest difference between this research and researches of other scholars is that it focuses on the bubble of the capital market, and believes that such bubble has a close relationship with the performance of listed companies at the time of IPO. To this end, the author has designed a unique evaluation index: PEG (PEG = P/E ratio / annual profit growth rate of the company). After cross-sectional multiple regression analysis, the author finds that venture capital does play a role in certification at IPO to effectively suppress the bubble of listed companies. Li Yuhua and Ge Xiangyu (2013) carried out empirical testing around GEM listed companies, with time of the IPO limited from October 2009 to July 2012. They observed that: By introducing and

making use of venture capital, listed companies have reduced their underpricing rates at the time of IPO. This means that venture capital generates a “certification role”. Compared with the previous empirical analysis by scholars, Chinese scholars pay special attention to the analysis on the degree of earnings management of listed companies before IPO, the first-day underpricing rate at IPO, and the annual average earnings per share after IPO. Furthermore, they also give answers in the empirical analysis of different types of venture capital and their impact on those aspects mentioned above. For example, Zhang Xueyong and Liao Li (2011) classified venture capital into three different types: private sector background, foreign investment background and mixed type according to the ownership status. By using cross-sectional multiple linear regression measurement, it is found that the IPO underpricing rate of companies invested by the venture capital with foreign investment background and mixed type background is low, and venture capital with private sector background has no significant impact on the underpricing rate of companies during IPOs. Zhang Xueyong, Liao Li, and Luo Yuanhang (2014) supported the “certification hypothesis”, and especially venture capital with a background of securities traders has played a certification role in the IPO process of companies. They used the data of companies listed on the Chinese A-share market after the restart of A-shares in 2009 to the end of July 2012, clearly distinguished the venture capital of background of securities traders from venture capital of other backgrounds, and conducted targeted empirical tests. After a

quantitative analysis, it was found that venture capital with a background of securities traders have a significantly positive impact on the underpricing rate of A-share listed companies during IPOs, while general venture capital does not have this effect. Therefore, they concluded that: A securities trader with a good reputation is the key to reducing the information asymmetry between the listed company and the capital market, which is closely linked to the certification effect of venture capital.

At the same time, some other scholars pointed out the reasons for not supporting the certification role of venture capital during IPOs. Zeng Wenqiang, Li Hongcheng, and Wang Jiayi (2010) expanded the research scope, investigating both the companies listed on the SME board and the GEM listed companies. Their test could not find a significant difference in the IPO underpricing rate between companies with venture capital participation and companies without venture capital background. This implies that the certification impact of risk investors on IPOs of companies may not work or may be not obvious. Zheng Qingwei and Hu Ridong (2010) investigated 44 listed companies supported by venture capital in the SME board market. The empirical research shows that for these companies, the “certification role” of venture capital is still a secret cannot be solved at least in these companies. In addition, some scholars used a comparative analysis method to investigate Chinese funded companies listed on the NASDAQ in the United States and the Hong Kong GEM market, and companies listed on the China Mainland’s SME board, studying the

certification role of venture capital for companies listed in different capital markets. The final conclusion is that the researches on companies listed on China's SME board do not seem to confirm the certification role of venture capital during IPOs.

(5) In the research of the market power hypothesis, Chemmanur and Loulskina reviewed and studied the early scholars' researches on the impact of venture capital during IPOs, and was surprised to find the contradiction of "certification hypothesis". According to Megginson and Weiss, the certification role of venture capital will reduce the underpricing rate of companies during IPOs. However, when inferring based on the certification hypothesis, it was concluded that the companies supported by venture capital will have higher underpricing rates during IPO. Because a lot of researches and analyses show that when capital markets are not completely effective, the closing price of a company on the first day of listing is about 10% higher than its actual value; and a high closing price represents a high underpricing rate. What went wrong? Chemmanur and Loulskina believed that the underpricing rate should not be used as an indicator to measure the role of venture capital. Therefore, in their empirical analysis, Chemmanur and Loulskina proposed the concept of intrinsic value of a company and regarded it as a perfect substitute for the indicator of closing price on the first day of listing. The final result verified the "market power hypothesis". The research horizons of scholars are thus broadened. Even so, the research of Chemmanur and Loulskina is not perfect, and their empirical analysis has weaknesses. For example, the

intrinsic value of a company includes subjective speculation that cannot be measured objectively through data. In order to further elaborate the credibility of the study, it is necessary to make a new empirical test of the market power hypothesis.

In the investigation of Chinese scholars on the impact of venture capital during IPOs by using data from GEM listed companies, Wang Wei (2013), Li Yao, Wang Xiujun (2015) and other scholars all mentioned the role of “market power” in venture capital. Wang Wei et al. (2013) analyzed the data of GEM listed companies from October 2009 to March 2012 and found that there is a positive correlation between the participation of venture capital and the IPO discount rate of companies. The higher of venture capital’s shareholding ratio in targeted companies and the proportion in the board of directors, the higher the discount rate during IPO.In other words, this study result confirms the “market power hypothesis” of venture capital. At the same time, they also believed that venture capital does not play a “certification role” during IPOs, so the certification hypothesis of venture capital fails. After investigating the situations of 355 companies successfully listed on GEM, Li Yao and Wang Xiujun (2015) found that: The certification role of venture capital during IPO and market power exist simultaneously, but the degrees of the two roles are different. And they asserted that the two roles are bound to be effective, but as the role of market power is greater than the certification role, the companies supported by venture capital will have a higher discount rate in the first day of IPO. Certainly, some scholars believed that venture capital does not have a

significant market power effect. In addition, scholars have designed different research programs based on differences in the backgrounds of venture capital to raise the awareness of the impact of venture capital during IPOs.

(6) After investigating the data of 2887 companies in the twelve years from 1983 to 1994, Hochberg (2003) found that due to the relatively independent structure of the board of directors, the probability of merging the positions of CEO and the chairman of the board of directors is low, and companies maintain a lower level of earnings management after IPOs due to venture capital. Wongsimwai (2007) used the company data in the THOMAS financial database to confirm that compared with those without venture capital funding, the boards of directors of companies funded by venture capital are larger and have a higher proportion of independent directors. Suchard (2009) constructed a measurement model covering venture capital, independent directors and business managers, and found that venture capital can help improve the independence of enterprises in that the proportions of independent directors and managers with relevant experience in these enterprises are higher.

In short, many researches hold that the value-added services (knowledge, technology, business know-how) provided to the target companies make venture capital play a positive role in the internal governance of the target companies to some extent. It can be seen that supervision mechanism no longer examines the behaviors of venture capital from the perspective of operating efficiency but integrates the

internal governance of enterprises into the overall analysis framework of venture capital from the perspective of operating efficiency. The influence of the supervisory effect of venture capital can be specifically verified in conjunction with the development of China's venture capital industry.

(7) Baker and Gompers (1999) employed data from 1553 listed companies in the United States to explore the impact of venture capital on corporate executive compensation. They pointed out that the equities obtained by executives before and after IPOs are "from low to high". Only when the company is successfully listed, can executives obtain equity incentives. This approach can reduce the reliance of executives on the right of control of companies for earning profits and encourage them to work hard. At the same time, by measuring the flexibility of the monetary compensation of executives and corporate performance, it was found that the participation of venture capital can more or less reduce the monetary compensation of executives, and the sensitivity of monetary compensation to corporate performance is higher than that of companies without the support of venture capital. Based on the real cases of venture capital, Kaplan and Stromberg (2000) emphasized that salary compensation is closely related to corporate performance, especially in case of the higher information asymmetry between venture capital and companies. Based on data from companies listed between 1993 and 1996, Campbell and Frye (2009) confirmed that from participation to exit, venture capital has a positive impact on improving internal governance capabilities of

corporates both in terms of quantity to quality. They were particularly concerned that in order to improve the internal governance of corporates, venture capital often uses the method of equity incentives.

Among Chinese scholars, when analyzing the flexibility of executive compensation performance, Wang Huijuan (2012) classified the Chinese GEM listed companies from 2006 to 2010 into two categories based on the participation of private equity funds. They believed that the increased flexibility of executive compensation performance and corporate governance can be explained by the participation of private equity funds. Shen Weitao and Hu Liufen (2014) added an investigation of the amount of venture capital in enterprises. After applying OLS regression analysis to 374 companies listed on the Shenzhen SME Board in China, they found that the funding of multiple venture capital is more conducive to the improvement of internal governance and management of enterprises than the participation of one venture capital. The amount of introduced venture capital and the proportion of professional directors in the board of directors is directly proportional to the flexibility of executive compensation performance. Based on these perspectives, the analysis of scholars on the incentive mechanism of venture capital has formed an important reference for our research and analysis.

2.3.2 Evaluation on relevant literature

After the trace analysis and review of the research literature at home and abroad, it can be found that there are still some flaws in the

relevant researches on the mutual impact between venture capital and operating performance of startups in Chinese and foreign academic communities, mainly as follows:

First, the literature paid too much attention to the creation or verification of relevant theories and hypotheses and lacked research on the mathematical associations between venture capital and operating performance of startups. Generally speaking, there are many kinds of associations, such as mathematical associations and causal associations. It will be better if mathematical associations, causal associations and other associations can be found at the same time. In the existing literature, there are many inferences and deductions of causal association which may have contradictions and most of which have not yet been finalized. While the mathematical associations are less studied, which seems to be insufficient to guide the practical operation.

Second, some studies of mathematical associations may be flawed in the methods, indicators, and data used. For example, China's IPO market has a price limit for a long time. For main board, SME, GEM listed companies, the price limits are 44% on the first day of IPOs, and resorted to 10% on the next day. As most stocks will have consecutive days of limit-up, the IPO underpricing rate is difficult to be in line with international standards, so the related research value is of little value. What's more, in the sample of listed companies in China, startups are mainly concentrated in the GEM, while the main board and SME board mainly consist of state-owned enterprises and traditional enterprises

that have a long history, which is significantly different from international startups. However, the sample analysis did not focus on the GEM, plus the relatively poor time validity, the conclusions drawn are questionable.

In this paper, the Chinese GEM listed companies are selected as a sample database for startups, which emphasizes the time validity of the samples in recent years. This study focuses on mathematical associations supplemented by the verification of related theories in order to deepen the understanding of the venture capital market and strengthen the practical value of research, which will not only benefit the author’s investment career but also help people improve the effectiveness of related investment activities.

Chapter 3 Development Process of Venture capital and Research Problems in This Study

For a long time, the developed economies of the world have attached great importance to the development of venture capital and have obtained valuable successful experience. Since the reform and opening up of China, venture capital has flourished and continued to develop. Through the analysis of the development process of venture capital, the problem directions of the mutual impact between venture capital and operating performance of startups can be introduced, and relevant research methods can be used to analyze the characteristics of relevant statistical data and create the research design of this study.

3.1 Development process of Chinese and foreign venture capital

American venture capital is undoubtedly the leader around the world, and some other advanced economies have also achieved excellent results, but with a process full of ups and downs. Chinese venture capital started after the reform and opening up, and developed rapidly in the process of learning from the developed economies such as the United States.

3.1.1 Development of foreign venture capital and characteristics by countries

(1) The United States

The United States is the world's most developed country in terms of venture capital, and its venture capital development has roughly gone through six stages.(Tian,2007)

The first is the beginning stage from the end of World War II to the early 1970s. In 1946, the United States founded the American Research and Development Corporation (ARD), whose purpose is to raise funds to support the numerous colleges and universities around Boston to transform the scientific and technological achievements of the laboratories into products that can be available to consumers as soon as possible. In 1958, the United States Congress passed the Small Business Investment Act and authorized the Federal Government to establish the Small Business Administration (SBA). Small business investment companies established under the approval of the SBA could enjoy tax incentives and government preferential loans. For every dollar invested, the small business investment company can obtain a low-interest government loan of 4 dollars, thus the investment enthusiasm was greatly stimulated. However, due to the long investment recovery period, short-term repayment of government loan interest and the single source of funds for small business investment companies, it gradually got into trouble by the end of the 1960s. Due to many problems in the development of small business investment companies, in the late 1960s and early 1970s, limited partnership venture capital companies that focused on absorbing individual capital gradually emerged in the United States, and led the American venture capital to be standardized and organized.

The second is the adjustment stage of 1971-1980. In the 1970s, the US economy entered a recession period due to the oil crisis, which resulted in the slow development of venture capital during adjustment. In 1971, the Nasdaq market was established, which provided a convenient exit channel for venture capital. In 1973, the National Venture Capital Association was established to promote the government to provide great support for venture capital in legislation and taxation. In 1978, the US Department of Labor revised the Employee Retirement Income Security Act to pave the way for introducing pensions to venture capital. In 1980, the US Congress passed the Small Business Investment Incentive Act, which allowed venture capital funds to not have to control investors within 14 people so as to raise more funds.

The third is the rapid growth stage of 1981-1989. In 1981, the United States lowered the capital gains tax rate from 28% to 20%, causing the scale of venture capital to expand rapidly. In 1982, the United States began to implement the “Small Business Innovation Research Program” to guide venture capital to lean toward high-tech SMEs and promote the industrialization of scientific and technological achievements. After this period of rapid development, the capital sources and invested industries of American venture capital were greatly improved.

The fourth is the mature stage of 1990-2000. In the 1990s, the U.S. economy entered a period of rapid development, with the overwhelming trend of the new economy. Venture capital played an important role in the American information technology revolution, promoting the rapid

development of high-tech industries such as the Internet, biotechnology, new energy, and new materials.

Fifth is the downturn stage of 2001-2009. After entering the new century, the US Internet bubble burst. The venture capital industry gradually declined from the peak, and entered a downturn with the IT industry. After 2004, venture capital began to recover, but by 2008, American venture capital fell again under the influence of the subprime mortgage crisis and the international financial crisis.

The sixth is the gradual recovery stage since 2010. The Internet bubble and the subprime mortgage crisis have made American venture capital pay more attention to diversified investment. With the recovery of the U.S. economy and the global economy, venture capital has recovered in 2010, with amount of funds raised, the number of investment projects and the number of IPO exit projects increased in fluctuation. Especially since then, the US stock market has entered a long bull market, which has contributed to the rapid expansion of venture capital.

(2) The United Kingdom

The United Kingdom was the first European country to develop venture capital and its venture capital market is the most fully developed in Europe, dating back to the establishment of the Industrial and Commercial Finance Corporation (ICFC) in 1945.(Wang,Xu, Chen,2006) In the 1970s, a group of venture capital managers who had gained rich experience in the US market came to the UK to bring their investment experience to the UK. In the 1980s, during Mrs.

Thatcher's time in office, the British government introduced a series of preferential policies such as tax incentives, loan guarantee plans and enterprise expansion plans, which brought the British venture capital industry into a booming period. In the mid-to-late 1990s, a group of British successful entrepreneurs, scientists and financiers gradually established a number of leading venture capital funds in London, Cambridge and Scotland, and investment in high-tech fields began to increase gradually. At present, British venture capital has exceeded 2 billion pounds among 1,200 companies.

As the early venture capital in the United Kingdom was mainly applied to leveraged buyout business and less involved in startups, British venture capital still tends to invest in established companies nowadays. The support for venture funds in the United Kingdom mainly adopts the method of participating in the establishment of guiding funds, in combination with other measures such as capital guarantees or subsidies for transaction costs at the same time. Instead of directly investing in SMEs, the government supports the establishment of commercial venture capital enterprises in various regions to promote investment in SMEs.

(3) Japan

Japan was the first Asian country to develop venture capital. (Xu,Xiao,Wu,2007) In 1951, Japan established the "Venture Development Bank" to provide low-interest loans to startups. Since the 1960s, the Japanese government successively launched a series of

policies and measures, and venture capital thus entered an accelerated stage. In the 1970s, due to the impact of the Middle East oil crisis and the lack of sound capital markets and venture capital experience, the first round of venture capital of Japan began to fall from its peak. In 1982, Japan's limited liability partnership fund opened up new channels for venture capital to raise funds, triggering the second peak of venture capital development. In 1986, with the sharp appreciation of Japanese Yen, many startups went bankrupt due to excessive equipment investment, finally ending the second climax of venture capital that lasted for three years.

In the early 1990s, in addition to securities companies and commercial banks, insurance companies, general manufacturing enterprises, and even some government agencies and economic groups actively supported the development of venture capital, which promoted a new wave of venture capital. In 1997, the bankruptcy of Yamaichi Securities and Hokkaido Takushoku Bank and the outbreak of the Asian financial crisis shocked the financial market in Japan, and the development of venture capital slowed down. Even to this day, due to the influences of bursting of IT bubble, the imperfect second-board market, the global financial crisis and the economic recession, Japanese venture capital institutions and total investment have not yet recovered to their peak.

(4) Germany

The German financial system is dominated by indirect financing, and bank-oriented financing has a large share. However, for special groups

such as high-tech and high-growth startup SMEs, traditional bank loan methods cannot provide full financing due to risk control and other factors.(Du & Tan,2004) In 1988, Germany established the Venture Capital Association in Berlin. After the 1990s, the total investment began to leap.

The sources of venture capital in Germany mainly consist of pensions, banks, insurance companies, governments, etc. In terms of the stage distribution, the startups in the seed and initial stages receive about 25% of capital, and startups at growth and expansion stages receive about 75% of capital. Since the German capital market is not well developed, exit of venture capitals by IPO is less, while liquidation accounts for a larger proportion.

(5) Israel

The venture capital industry in Israel started in 1993-2000. During this period, venture capital grew rapidly at an average rate of 85% per year. The government set up the Yozma fund to implement a new set of national preferential development strategies, aiming at complying with domestic and foreign environmental changes which include the immigration of a large number of scientists and engineers from the former Soviet Union into Israel in the early 1990s, the ineffectiveness of government research funding, and the lack of management and commercialization capabilities in the country. (Wang & Liu,2003) The scale of Israel's venture capital industry in 1997 was USD 440 million,

and it grew to USD 1.759 billion in 2007, mainly investing in high-tech fields including ICT and biotechnology.

Israeli venture capital is mainly invested in the start-up period of enterprises. Since the venture capital companies from the United States also invested heavily in Israeli startups and high-tech, the Nasdaq market has become a common exit channel for the venture capital in both the United States and Israel.

3.1.2 Rise and development of Chinese venture capital

The high-tech enterprises and venture capital in China are outcomes of reform and opening up. The development process of Chinese venture capital since the 1980s can be roughly divided into six stages.

The first stage is the gestation and exploration stage from 1987 to 1997. In 1985, the CPC Central Committee issued the *Decision on the Reform of Science and Technology Management System*, clearly proposing to allow the venture capital to support the development of high-tech enterprises with higher risks, which kicked off development of Chinese venture capital. In September 1985, China's first venture capital company - China Venturetect Investment Corporation (CVIC) was established. Since the 1990s, venture capital has been highly valued at the national level. In 1991, the State Council promulgated the *Interim Provisions on Certain Policies Concerning National High Technology and New Technology Industry Development Zones*, permitting high-tech zones to independently establish venture capital companies to support the development of high-tech industries; in 1995

and 1996, the State Council repeatedly emphasized the development of science and technology venture capital funds in a series of documents including the *Decisions on Strengthening Scientific and Technological Progress*; in 1997, the State Council organized seven ministries and commissions to set up the group of “National Venture Capital Mechanism Research”, formally promoting the development of venture capital as national strategy.

The second stage is the rapid development stage from 1998 to 2000. In March 1998, the China National Democratic Association Central Committee submitted the *Proposal on Quickly Developing Chinese Venture capital*, which was listed as the No. 1 proposal of CPPCC that year, clearly suggesting that promoting venture capital should be a basic policy to boost the development of high-tech industries. Since then, the development of venture capital has been pushed to a new high. In March 1999, the Ministry of Science and Technology issue the *Several Opinions on the Establishment of Venture capital Mechanism* with seven ministries and commissions, allowing venture capital institutions to support the development of high-tech enterprises by establishing venture funds and financing guarantee funds. Since then, Shenzhen, Beijing and other local governments have followed the example of the Central Government and proposed a series of policies and measures to promote the development of venture capital. During this period, with the vigorous supports of the Central Government and local governments, Chinese venture capital has witnessed an

astonishing growth in terms of both the number of companies and the total amount of venture capital.

The third stage is the industrial adjustment stage from 2001 to 2004 With the bursting of the Internet bubble in the United States in 2001, China's venture capital also reached a low point of development. The GEM market, which was the best way for venture capital to exit, has been delayed to launch again. A large number of venture capital companies collapsed because of the failure to recover capitals. At the same time, the government carried out some institutional innovations at this stage. In 2004, the Shenzhen Stock Exchange launched the SME board market, which opened up new channels for venture capital companies to realize capital appreciation and exit, and promoted the development of the Chinese venture capital.

The fourth stage is the rapid expansion stage from 2005 to 2010. 2005 was a divide in the development history of Chinese venture capital, and also the first year for Chinese venture capital to enter a stage of rapid expansion. It was mainly manifested in the effective support for the development of Chinese venture capital provided by a series of system constructions. In November 2005, the National Development and Reform Commission and other nine ministries and commissions jointly introduced the *Interim Measures for the Administration of Startup Investment Enterprises*, which made clear provisions on the establishment and investment operation of startup investment companies for the first time, and simultaneously allowed the government to set up startup investment guidance funds to formed a

demonstration effect for the development of startup investment companies. In February 2006, the State Council issued the *Several Supporting Policies for Implementing the National Medium- and Long-Term Science and Technology Development Program Outline (2006-2007)*, which incorporated “accelerating the development of venture capital” and “establishing multi-level capital markets which support independent innovation” into the national science and technology development strategy, which provided policy guarantee for the venture capital. In the same year, the China Securities Regulatory Commission issued relevant documents that allowed the Zhongguancun Science and Technology Park to pilot the “agency transfer system of shares of non-listed companies”, which broadened the channels for the transactions and exits of venture capital. In October 2009, the GEM market that had been nurtured for ten years was officially launched on the Shenzhen Stock Exchange. It opened up a new path for the development of startups and the exit and capital appreciation of venture capital, which is of great significance for encouraging the development of Chinese venture capital and startups.

The fifth stage is the deep adjustment stage from 2011 to 2015. Since 2011, due to the slowdown of domestic economic growth and the downturn in the capital market, Chinese venture capital once again fell into the deep adjustment stage. Especially from November 2012 to December 2013, China actually suspended the issuance of new shares, and the decrease of exit channels made the venture capital worse. During this period, although Chinese venture capital was in trouble

again, it maintained a relatively high growth in terms of overall scale. At the same time, in order to regulate the development of venture capital, China also issued a series of policy documents. For example, the NDRC issued the *Notice on Further Regulating the Development and Filing Management of Equity Investment Enterprises* and *Notice on Promoting the Standardized Development of Equity Investment Enterprises* respectively in January and November 2011, which played an important role in regulating the market behavior of venture capital companies.

After July 2014, Chinese stock market began to rise, and venture capital began to recover gradually. During the period, there was a total of 172 exits. The successful listing of companies such as Alibaba and JD.com brought stunning exit rewards to the institutions including Softbank China and Capital Today.

In 2015, Chinese stock market rose sharply in the first and second quarters, and many venture capital projects were able to exit at a high premium, with an obvious wealth effect. However, in the third quarter, a well-known stock market crash broke out, wiping out a lot of wealth. Especially from July to November, China once again suspended the IPO market, and the stock market fell down with venture capital.

The sixth stage is the calm development stage from 2016 to the present. Since 2016, the development of Chinese venture capital has been relatively peaceful. Due to the slowdown in economic growth, the switching of the new growth drivers of new economy is continuing, and

there are many investment opportunities in the AI and other fields. Since 2019, the China-US trade war has highlighted the hard core technologies such as chips, and the role of government-led equity investment capital has been strengthened. Meanwhile, the valuation bubble in the field of venture capital has also attracted more attention, including that the difficulty of Wework invested by Japan Software also gave a warning to global venture capital[①]. In general, the performance of venture capital is relatively stable and calm.

On June 13, 2019, China's Science and Technology Innovation Board was officially opened. On July 22, the first batch of companies was listed on the Science and Technology Innovation Board. The establishment of the Science and Technology Innovation Board has created a new channel for the exit of venture capital, which benefits the development of venture capital.

3.1.3 Reference from the development experience of Chinese and foreign venture capital

Comparing the developments of venture capital in internationally developed economies and China, some successful experiences can be found, which are mainly reflected in four aspects.

First, the government guides the development of venture capital and provides an important source of funds. In foreign countries, the United States established the Small Business Administration (SBA) in 1958 to

① HuXiu.(2019,October 9).*Softbank Reinvests in WeWork: Who is the Rescuer?*. https://m.huxiu.com/article/320888.html

lead the Small Business Investment Corporation (SBIC) to provide startup capital for small businesses, creating a precedent for the guidance funds of government-supported venture capital; the Israeli government allocated USD 100 million in 1993 to set up the wholly state-owned YOZMA fund which was positioned as a “parent fund” to attract private and overseas capital to initiate and set up equity investment funds. In 1998, the United Kingdom founded a government guidance fund for startup investment, investing 100 million pounds in the first phase to support the establishment of government guidance sub-funds in various regions, and employed capital guarantees, transaction cost subsidies and other measures for complex operations.

After entering the new century, China has also actively set up government guidance funds to attract social capital into venture capital. In January 2002, Zhongguancun Startup Investment Guidance Fund, the first real startup investment guidance fund in China, was formally established. In July 2007, the Ministry of Science and Technology and the Ministry of Finance jointly established the first national-level guidance fund with an initial scale of 100 million yuan. In October 2008, China issued the *Guiding Opinions on the Standard Establishment and Operation of Startup Investment Guidance Funds*, which provided several normative requirements for the establishment and operation of the guidance funds and had a positive and far-reaching impact on the development of Chinese startup investment. In October 2009, the NDRC and the Ministry of Finance jointly launched the “Startup Investment Plan for Emerging Industry”, with the first batch of pilots in

seven provinces and cities including Beijing, Shanghai, Shenzhen, Chongqing, Anhui, Hunan, and Jilin. In September 2014, the Ministry of Industry and Information Technology and the Ministry of Finance founded the National Integrated Circuit Fund (commonly known as the "Big fund"), with the first phase of raised funds reaching 120 billion yuan. Its purpose is to support the local chip industry of China to reduce the reliance on foreign manufacturers. In October 2019, the fund raised 204.15 billion yuan in the second phase, which will further realize the leap-forward development of China's integrated circuit industry. Under the active guidance of governments at all levels, Chinese venture capital has developed rapidly, and many venture capital clustering areas have emerged, such as Beijing, Shenzhen, Shanghai, and Tianjin.

Second, the government introduces relevant laws, regulations, and policies to strengthen the establishment of a venture capital system. In foreign countries, the United States launched the Small Business Investment Act to encourage innovation and industrial development, and amended the Employee Retirement Income Security Act to pave the way for pensions to enter startup investment funds; Japan has innovated the limited partnership system to facilitate the rapid development of partnership startup investment funds. China issued the *Interim Measures for the Administration of Startup Investment Enterprises* in 2005, and released the *Guiding Opinions on the Standard Establishment and Operation of Startup Investment Guidance Funds* was published in 2008 to regulate the establishment of startup

investment funds and their guidance funds. Some local provinces and cities, especially some provincial capital cities, have introduced administrative measures for guidance funds of startup investment funds. These laws, regulations, policies and measures have provided important institutional guarantees for the healthy and rapid development of startup investment.

Third, the capital market system is improved and the exit channels for venture capital are enriched. In order to promote the financing of small and medium-sized enterprises and help analyze the investment and exit, the United States established the Nasdaq market in 1971, which became the most successful global second board market; the United Kingdom also created the second board market AIM (Alternative Investment Market) in 1995 to aid the financing of British and overseas start-up and high-growth companies. In addition to the main board market, China launched the SME board market in 2004, the GEM board in 2009, and expanded the original agency system of equity transfer of Zhongguancun Science and Technology Park to the “New OTC Market” for the whole country in 2013, and launched the Science and Technology Innovation Board in 2019. Furthermore, various places have launched regional equity trading centers. A multi-level capital market system has been built, which provides rich mechanisms and channels for venture capital exit and SME financing.

Fourth, a venture capital organization system is established to introduce funds into startups. Due to its high risk, venture capital needs government incentives, guidance and regulation. In foreign countries,

the United States allowed the establishment of small business investment companies and provided financial support in 1958 to promote the development of venture capital institutions. In 1973, the National Venture Capital Association was set up to promote government to provide support for venture capital in legislation and taxation. Germany also established a similar venture capital association in 1988. In China, local governments have actively propelled the construction of organization system of venture capital, and established a large number of state-owned venture capital companies, startup investment promotion centers, etc., as well as industrial self-regulatory startup investment associations and alliances, which have contributed to the development of local venture capital.

3.2 Introduction to the research problems

3.2.1 Research problems in this study

Since the 1980s, Chinese venture capital has continued to develop and thrive, and it is still in prosperity to this day. It has become a supporting power for the switching of the new economy and new growth drivers, and it has also become a booster for “Widespread Entrepreneurship and Innovation”, with obvious positive externalities.

From a micro perspective, the capital and project parties are the two main players in the venture capital market, and venture capital and startups are interdependent and closely linked. Among them, the relationship between venture capital and operating performance of startups has become a focus of attention. Some views, such as

regulatory mechanism effect and incentive mechanism effect, believe that the introduction of venture capital may improve the operating performance of startups, while some views, such as the adverse selection hypothesis and the grandstanding hypothesis, argue that the introduction of venture capital may not necessarily improve the operating performance of startups, and may even damage the operating performance of startups. On the other hand, the operating performance of startups may also have an impact on the introduction of venture capital. For example, the adverse selection hypothesis believes that due to the preference and adverse selection of venture capital, startups with poor performance may be more likely to earn the favor of venture capital.

The Chinese venture capital market has many twists and turns in development path, and is particularly easy to follow the ups and downs of the stock market. It has different characteristics at different stages, which is difficult to form a general conclusion on the mutual impact between venture capital and operating performance of startups, and some staged characteristics can be obtained only by combining new changes and new data. The paper uses the GEM listed startups from 2016 to 2018 as samples, and the venture or venture-free investment as a dummy variable to study the mutual impact between venture capital and operating performance of startups. The main research problems are:

(1) What is the impact of venture capital on the operating performance of startups?

(2) What are the causes for the impact of venture capital on the operating performance of startups? How is the specific impact manifested? What are the specific effects?

(3) How to deal with the impact of venture capital on the operating performance of startups?

3.2.2 Reference of research methodology

By comparing previous studies, it can be found that the regression-related methods are mainly employed in the studies of the mutual impact between venture capital and the operating performance of startups.

The first is the binary OLS regression. The ordinary least square (OLS) is mainly applied to describing the relationship between the explained variable and the explaining variable. For example, Shen Weitao and Hu Liufen (2014) conducted an investigation on the number of venture capital in enterprises. After applying OLS regression analysis to 374 companies listed on the Shenzhen SME Board in China, they found that the funding of multiple venture capital is more conducive to the improvement of internal governance and management of startups than the participation of one venture capital. The amount of introduced venture capital and the proportion of professional directors in the board of directors is directly proportional to the flexibility of executive compensation performance.

Xu Zhiwen (2018) took the GEM listed companies from 2014 to 2017 as the research object, and used OLS regression analysis to empirically

test the impact of PE on the operating performance of companies. The operating performance of companies were measured from the four aspects of profitability, solvency, operating capability, and growth ability, with the presence or absence of PE, the joint investment amount of PE, the shareholding proportion of PE, and the investment years of PE as explaining variables, and the company scale, the asset-liability ratio, the proportion of top ten shareholders, company background, macro economic factors as control variables. Empirical research results indicate that the operating performance of companies with PE participation is better; the higher the shareholding ratio of PE, the better the operating performance of companies; the investment years of PE have a negative impact on the operating performance of companies; the joint investment amount of PE has a less obvious impact on the operating performance of companies.

The second is cross-sectional multiple linear regression. It is mainly used when there are multiple explaining variables and the acquired data is cross-sectional data. For example, Zhang Feng (2009) selected 256 listed companies on the SMEs board from June 25, 2004 to June 30, 2008 as the research object to establish a mean comparison and multiple regression analysis model, and explain the mechanism by which venture capital affects the IPO of startups. Chen Gongmeng, Yu Xin and Kou Xianghe (2011) adopted multiple linear regression method for investigating the “three places and four boards” (Shenzhen SME Board, Hong Kong Main Board, New York and NASDAQ) to compare the adjusted return in the first day of listed companies with or without

venture capital support, and found that the grandstanding hypothesis of venture capital exists objectively, especially among newly established venture capital institutions whose supported companies obviously have a shorter listing cycle.

Song Fangxiu and Li Chenchen (2014) conducted empirical research by employing the cross-sectional multiple linear regression method based on ROA, ROE and other financial indicators, believing that there is an adverse selection of venture capital in the GEM. Zhang Xueyong and Liao Li (2011) classified venture capital into three different types: private sector background, foreign investment background and mixed type according to the ownership status. By using cross-sectional multiple linear regression measurement, it is found that the IPO underpricing rate of companies invested by the venture capital with foreign investment background and mixed type background is low, and venture capital with private sector background has no significant impact on the underpricing rate of companies during IPOs.

The third is other regression methods. Some improved regression methods are mainly employed according to study needs. For example, Chemmanur and Krishnan (2011) used the longitudinal research database of the US Census Bureau and adopted the endogenous switching regression model, regression discontinuity, PSM and other research methods to carry out the empirical testing for the TFP of target companies before, during, and after venture capital support.

By referring to previous studies, this study mainly adopts the following research methods in empirical analysis:

(1) In the study of the impact of venture capital on the operating performance of startups, the cross-sectional multiple linear regression method is mainly employed, and the multiple regression is performed with the dummy variables and control variables of the relevant indicators and constructs of profitability, operating capacity, and solvency, in order to investigate the impact of venture capital on the operating performance of startups in different dimensions.

(2) Control variables are introduced in the multiple regression which includes the actual control variables, such as the “logarithm of total assets” that represents the size of the companies, and the “shareholding ratio of venture capital” that represents the participation of venture capital, and also includes the sub-dummy variables that represent the fixed annual effect and industrial effect for getting closer to the actual situation in order to deepen the regression model.

3.2.3 Data sources

The data to be used in this study are all third-party public data. The main data sources include:

(1) GTA “IPO Research Database for Listed Companies in China”. The database collects data on prospectuses, listing particulars, issuance results announcements, share change announcements, corporate governance, share capital, finance and market performance on the first day of listing released by A-share listed companies on the Shanghai

Stock Exchange and Shenzhen Stock Exchange, including information on all aspects of the issuance process from issuance review, IPO, subscription to listing. This study mainly uses the relevant data of GEM companies from the public data of this database.

(2) Eastmoney.com Choice Database. Choice Database is a professional financial data platform under Eastmoney.com, dedicated to providing professional financial data services for users including financial investment institutions, research institutions, academic institutions, regulators and media, involving public financial data of listed companies and pre-IPO statistical data etc.

(3) Wind Database. Information about the financial indicators of companies, industry information and macro information can be obtained through the industry database in this software and the investment time of private equity investment institutions can be inquired in “PEVC” library in the software, which are mainly used for verification in this study.

(4) Chinaventure.com. It is mainly used to verify the investment time of private equity investment institutions. In order to minimize the error of investment time of private equity investment institutions, the companies, venture capital institutions and investment time obtained from the “PEVC” library of Wind are re-entered into Chinaventure.com. for verification.

(5) Zdatabase. It is mainly used for inquiring and verifying related information of venture capital institutions.

3.3 Research framework

This paper takes the impact between venture capital and operating performance of startups as the theme. The overall research framework is to use the public data of GEM listed companies to conduct empirical research, conduct cause and effect analysis in combination with empirical research results, and put forward relevant countermeasure suggestions through qualitative comparison and summary.

3.3.1 About empirical analysis

The empirical analysis of the impact of venture capital on the operating performance of startups is mainly carried out. The operating performance of startups mainly includes profitability, solvency, and operating capabilities. Two related indicators are adopted in each dimension, which are used as the explained variables in the multiple regression with the dummy variable being as explaining variable herein: “venture or venture-free investment” (venture capital = 1, venture-free investment = 0). In the meanwhile, in order to improve the regression accuracy, the necessary control variables are introduced in the regression. It is generally believed that introducing control variables will improve the accuracy and saliency of the entire regression model, but control variables cannot be introduced excessively. The author notes that some literature introduces listing dates, stock codes, etc. as control variables into the model, the economic significance is questionable.

In this paper, ROE and ROA are mainly used to represent the profitability of the operating performance of startups; CR and QR

represent the solvency of the operating performance of startups; I_TURNOVER, TAT represent the operating capabilities of operating performance of startup. By constructing the dummy variables “venture or venture-free investment” and selecting control variables, regression analysis is conducted respectively for the explained variables including ROE, ROA, CR, QR, I_TURNOVER and TAT, so as to determine and analyze the impact of “venture or venture-free investment” on the operating performance of startups.

At the same time, among the control variables, the explaining variables such as the shareholding ratio of venture capital and the logarithm of total assets are introduced, and two sub-dummy variables that represent relative years and 33 sub-dummy variables that represent relative industries are also introduced, which finally form the regression model combining dummy variables, control variables and multiple sub-dummy variables. Although it is different from the previous research on the setting of control variables, this research model has been widely used in other fields and is relatively mature, which can be regarded as a reference of other fields being applied in the field of venture capital.

3.3.2 About cause and effect analysis of adverse selection

After empirical analysis, this study finds that venture capital and operating performance of startups mainly is negatively correlated, and the reason is that there is an adverse selection the process of venture capital.

The causes and effects of adverse selection are noteworthy. The qualitative analysis on causes and effects of adverse selection will enhance the understanding of the venture capital market characteristics, such as the possibility of increasing venture capital for startups, lemon market, valuation bubble, moral risks, and threshold issues. This is a deductive analysis process that combines empirical analysis with real practice.

3.3.3 About countermeasure suggestions

Based on the empirical analysis of the mutual impact between venture capital and operating performance of startups, corresponding countermeasure suggestions can be put forward through qualitative analysis, comparative analysis, and summary analysis.

Venture capital and startups are important players in China's venture capital market. In addition, for GEM market, an important exit channel for venture capital, other institutions, regulatory authorities and various investors are also included. Based on the mutual impact between venture capital and operating performance of startups, as well as the mechanisms and causes of these impacts, relevant strategic suggestions can be provided for venture capital, startups and other participants in the capital market, which will output and deepen the value of this study.

Chapter 4 Empirical Analysis of the Impact of Venture capital on the Operating Performance of Startups

This chapter will employ the relevant statistical data of Chinese GEM listed companies to put forward research hypotheses, conduct an empirical analysis of the impact of venture capital on the operating performance of startups, and verify the relevant assumptions to draw certain conclusions.

4.1 Indicator selection, data analysis, and research hypotheses

There are many startups in Chinese GEM market, so it is of representative significance to use the GEM listed companies as the samples for studying the mutual impact between venture capital and operating performance of startups

4.1.1 Indicator selection

Relevant data since the opening of the Chinese GEM market in October 2009 can be inquired from GTA “IPO Research Database for Listed Companies in China”, Eastmoney.com Choice Database and other databases. But there is a large number of missing values on the subdivision indicators of these data. After observation and calculation, it is found that there are a lot of missing values in relevant indicators in the data of the early stage and last year. Besides, July to November 2015 was the last time of IPO suspension due to the disaster of Chinese stock market and 2016 to now is a relatively peaceful and

mature stage of the development of China's venture capital. Therefore, only the GEM listed companies in 2016-2018 are used as samples. This study makes some trade-offs in relevant indicators after comprehensive consideration, which is explained as follows.

(1) About the indicators of the operating performance of startups

The operating performance of startups is a general concept, usually including profitability, solvency, operating capabilities, etc. Due to the extremely unstable growth capabilities of startups, the annual changes of relevant indicators including operating income growth rate, total asset growth rate, operating profit growth rate, net profit growth rate and net asset growth rate are too large. So, this study excludes the growth capability indicators covered in a few literature. In addition, the multiple indicators used to represent a certain capability are mostly derived from a certain conversion and have a certain degree of homogeneity. In this study, two indicators are selected for each capability.

There are many relevant indicators for profitability, mainly including operating profit margin, net profit margin, gross profit margin, cost expense profit margin, ROA, and weighted ROE according to Tongdaxin stock software. Among the available data, weighted ROE and ROA have fewer missing values, and are applied in relevant analysis more often. This study mainly chooses weighted ROE and ROA to represent the profitability of startups.

Solvency mainly includes indicators such as CR, QR, asset-liability ratio and equity ratio according to Tongdaxin stock software. Among the available data, CR and QR have fewer missing values, and are applied in relevant analysis more often. This study mainly chooses CR and QR to represent the solvency of startups.

Operating capabilities mainly include indicators such as I_TURNOVER, current asset turnover rate, fixed asset turnover rate, TAT and growth rate of cash flow per share (%) according to Tongdaxin stock software. Among the available data, I_TURNOVER and TAT have fewer missing values, and are applied in relevant analysis more often. This study mainly chooses I_TURNOVER and TAT to represent the operating capabilities of startups.

(2) About dummy variables

Dummy variables, also known as pseudo variables, nominal variables, or dummy argument, are artificial variables reflecting qualitative attributes, and are quantified independent variables. Their values are usually 0 or 1. The introduction of dummy variables can make the linear regression model more complicated, but describe problems in a more concise manner, which can achieve the function of two equations and is close to reality.

For GEM listed companies, “venture capital” is distinguished from “venture-free investment”. Venture capital is denoted as 1, venture-free investment is denoted as 0, and a dummy variable is constructed, which is introduced into the regression equation as explaining variables.

Essentially two equations are constructed, one for the regression of listed companies without venture capital, and the other for the regression of the listed companies with venture capital. When they are subtracted, the explained variables on the left side of the equation can be characterized by the difference between venture capital and venture-free investment, while some control variables can be added to on the right (or not) to promote the goodness of fit of the regression equation.

In this study, having venture capital means that a startup has accepted venture capital (VC) or private equity (PE) before the IPO, while venture-free investment means there's neither VC nor PE. Both VC and PE are equity capital. VC investment will occur in early stage, PE investment will occur in late stage of startups, and there is no essential difference between them. Many VCs play the same role with PE, so does PE. It is called VC mainly because it has state subsidies. Both of them are regarded as venture capital in this study (the dummy variable of "venture or venture-free investment" is denoted as VC).

(3) About control variables

Relevant indicators such as profitability, solvency, and operating capabilities of startups are used as explaining variables. To construct regression equation by introducing control variables can improve the goodness of fit of regression equation and better characterize impact of "venture or venture-free investment" on these capabilities under constrained conditions. However, it is not easy to find quantifiable

control factors that characterize these capabilities. Because profitability, solvency and operating capabilities are not only affected by the companies themselves, but also by the meso-level and macro-level of industry development, domestic and foreign economic trends, etc. They are also affected by many external factors such as the leadership of the startup team and government support. This paper attempts to introduce indicators including the shareholding ratio of venture capital, company size, industry growth, and national GDP growth as direct control variables, but finds that the regression effect is not obvious and insufficient to improve the goodness of fit, so a certain transformation is required.

The shareholding ratio of venture capital is denoted as VCR in this paper, which directly brings the shareholding ratio of venture capital (%). And the shareholding ratio of venture-free investment is 0.

In terms of company size, the logarithm of total assets is taken as the control variable, denoted as LNTA, which represents the conditional factors of company size that affect regression changes and results.

At the macro level, the annual GDP growth rate (denoted as GDPR) is directly brought into the regression calculation as a control variable, but the goodness of fit of the overall regression is found to be poor. Therefore, from the perspective of fixed effect of the control year, new dummy variables are introduced again. 2015 is denoted as 1 and the years other than 2015 (including 2016 and 2017) as 0, so as to obtain the dummy variable of GDPRYEAR2015 (not for regression). Based on

this, the dummy variables GDPRYEAR2016 and GDPRYEAR2017, which are introduced into regression equation and express the annual GDPR fixed effect, can be set.

At the meso level of the industry, the industry sales margin (denoted as ISM) is used to represent the development of the industry. The 232 samples involve a total of 34 industries, and the largest part of samples (47 in total) from “computer, communications and other electronic equipment manufacturing industries” is taken as the basic group denoted as industry0, which doesn’t participate the regression equation, thereby constructing the remaining 33 dummy variables industry1~industry33 that represent the fixed effects of the industry and participate in regression.

4.1.2 Data analysis

(1) Data description

Chinese GEM listed companies in 2016-2018 are adopted as samples, which covers the financial data of 2015, 2016, and 2017 at the time of the IPOs of all GEM listed companies, and a total of 232 samples of GEM listed companies are obtained with missing values in weighted ROE, ROA, CR, QR, I_TURNOVER and TAT excluded.

It should be noted that GEM listed companies in 2009-2018 and 2014-2018 have used as different segmented samples to establish a regression model. But only the size of the parameters and the significance level are changed, without changing the directions of the symbols. Therefore, the economic meaning of regression is essentially

the same and does not have a substantial impact on the conclusions of this paper.

In addition, the cross-section of sample data is based on the time of IPOs of GEM listed companies, dating back to the data of the most recent year before the IPO. Therefore, as the control variable of company size, the “total assets (TA)” does not take the time value of capital into account. Fortunately, after the logarithm (LNTA) is adopted, this difference is basically negligible. And other indicators are relative numbers or dummy variables, which avoids the problem of the time value of capital.

(2) Descriptive statistics

Firstly, a descriptive statistical analysis is carried out for the relevant financial indicators of 232 sample of Chinese GEM listed companies from 2016 to 2018 by EViews software. The results are shown in the following table (Table 4-1).

Table 4-1 Descriptive statistics of 232 Chinese GEM listed companies from 2016 to 2018

	VC	VCR(%)	LNTA	ROE	ROA
Mean	0.780172	10.83816	20.21308	22.19039	17.34515
Median	1.000000	6.520000	20.07497	19.48000	15.86347
Maximum	1.000000	81.73000	24.62852	69.35000	64.28745
Minimum	0.000000	0.000000	18.96903	4.740000	4.353586
Std. Dev.	0.415025	14.47167	0.731486	10.82130	8.812277
Observations	232	232	232	232	232
	CR	QR	I_TURNOVER	TAT	
Mean	2.755644	2.222139	18.19666	0.876819	
Median	2.115631	1.694903	3.204593	0.791147	

Maximum	18.02062	16.54461	1894.535	2.544212	
Minimum	0.344898	0.156192	0.562870	0.193353	
Std. Dev.	2.132317	1.973223	134.0703	0.365066	
Observations	232	232	232	232	

According to the results in Table 4-1, the relevant indicators of the 232 sample companies have the following features.

For the indicator VC for venture and venture-free investment, the mean value is 0.78. There is a total of 232 samples, including 181 with venture capital and 51 without venture capital.

In terms of VCR, the mean value is 10.84%, the median value is 6.52%, the maximum value is 81.73%, the minimum value is 0, and the standard deviation is 14.47%. Among them, the maximum value is a bit of special. After checking, it is due to 300735 DBG, similar to 300660 Jiangsu Leili, 300722 Xinyu Guoke, 300689 Chengtian Weiye, 300727 Runhe Materials, 300669 Huning Shares, 300580 Best, 300739 SG Circuits, whose shareholding ratios of venture capital all exceed 50%. Considering that there may be multiple venture capitals, it is still regarded as normal.

In terms of logarithm of total assets (LNTA), the indicator representing the company size, the mean value is 20.21, the median value is 20.07, the maximum value is 24.63, the minimum value is 18.97, and the standard deviation is 0.76, which is at a normal level.

The weighted ROE has a mean value of 22.19, a median value of 19.48, a maximum value of 69.35, a minimum value of 4.74, and a standard

deviation of 10.82. Considering the features of different industries, it is generally at a normal level.

The ROA has a mean value of 17.35, a median value of 15.86, a maximum value of 64.29, a minimum value of 4.35, and a standard deviation of 8.81. Based on the features of different industries, it is generally at a normal level.

CR has a mean value of 2.76, a median value of 2.16, a maximum value of 18.02, a minimum value of 0.34, and a standard deviation of 2.13. Considering the features of different industries, it is generally at a normal level.

QR has a mean value of 2.22, a median value of 1.69, a maximum value of 16.54, a minimum value of 0.16, and a standard deviation of 1.97, which is generally at a normal level.

I_TURNOVER has a mean value of 29.26, a median value of 3.23, a maximum value of 3789.07, a minimum value is 0.56, and a standard deviation of 262.97. Among them, the maximum value is quite special. After checking, it is due to the stock 300758 Shengxunda, whose main business is mobile game development and sales. Similar stocks with high I_TURNOVER include 300746 Hanjia Design, 300675 IBR, 300598 ARCHERMIND, 300738 SG Circuits, mainly concentrating on research, development and design companies. There are many R&D companies among GEM listed companies. Such companies are dominated by innovation and startup, generally with a very high I_TURNOVER. After careful consideration, the value of this indicator is

regarded as normal in this study in order to reflect the features of such companies.

TAT has a mean value of 0.88, a median value of 0.79, a maximum value of 2.54, a minimum value of 0.19, and a standard deviation of 0.37, which is generally at a normal level.

On the whole, the data used in this paper are public statistical data. It is generally believed that non-questionnaire statistics that indicate real occurrences may not process the extreme values unless their existence is unreasonable.(Chang & Zhang,2008) In order to express the objectivity of real practice, the extreme values of each data will not be processed in this study.

Secondly, for the annual GDPR intended to be introduced into regression, the GDP growth rates of China in 2015, 2016, and 2017 were 6.9%, 6.7%, and 6.8% respectively. It is specially noted that two sub-dummy variables, GDPRYEAR2016 and GDPRYEAR2017, are set up for 2015 when controlling the fixed year effect of GDPR in this study.

For the industry growth rate intended to be introduced into regression, a total of 34 industries are involved. “Computer, communications and other electronic equipment manufacturing industries” is used as the basic group coded INDUSTRY0, and the remaining industries are set to sub-dummy variables. The statistics of number of sample distributions in industries and the number of samples with VC are as follows (Table 4-2):

Table 4-2 Industry distribution of samples

Industry	Code	Number of samples	Number of samples with VC
Computer, communications and other electronic equipment manufacturing industry	INDUSTRY0	47	36
Animal husbandry	INDUSTRY1	1	1
Electrical machinery and equipment manufacturing industry	INDUSTRY2	13	10
Textile industry	INDUSTRY3	2	2
Non-metallic mineral products industry	INDUSTRY4	6	3
Radio, television, film and recording operations	INDUSTRY5	1	1
Chemical fiber manufacturing industry	INDUSTRY6	1	1
Chemical raw materials and chemical products manufacturing industry	INDUSTRY7	21	15
Motor vehicle, electronic product and daily product repair industry	INDUSTRY8	1	1
Furniture manufacturing industry	INDUSTRY9	3	1
Building decoration and other construction industries	INDUSTRY10	1	1
Metal products industry	INDUSTRY11	1	0
Retail	INDUSTRY12	2	2
Agricultural and sideline product processing industry	INDUSTRY13	1	1
Agriculture	INDUSTRY14	1	1
Wholesale trade	INDUSTRY15	1	1
Leather, fur, feather and their products and footwear industry	INDUSTRY16	1	1
Other manufacturing industries	INDUSTRY17	2	1
Automotive manufacturing industry	INDUSTRY18	10	10
Software and information technology services	INDUSTRY19	33	31
Ecological protection and environmental governance	INDUSTRY20	2	1
Railway, shipping, aerospace and	INDUSTRY21	4	3

other transportation equipment manufacturing industries			
General equipment manufacturing industry	INDUSTRY22	9	6
Civil engineering and construction	INDUSTRY23	2	1
Culture and arts	INDUSTRY24	2	2
Culture, education, industrial arts, sports and entertainment products manufacturing industry	INDUSTRY25	3	2
Rubber and plastic products industry	INDUSTRY26	10	8
News and publishing industry	INDUSTRY27	1	1
Research and experimental development	INDUSTRY28	1	1
Pharmaceutical manufacturing industry	INDUSTRY29	17	13
Instrumentation manufacturing industry	INDUSTRY30	8	5
Non-ferrous metal smelting and rolling processing industry	INDUSTRY31	2	1
Professional technical service industry	INDUSTRY32	4	4
Special equipment manufacturing industry	INDUSTRY33	18	13
Total		232	181

4.1.3 Research hypothesis

According to previous research results, the operating performance of startups is mainly expressed in three dimensions of profitability, solvency and operating capability. Combined with the research problem hypothesis of Zhang Lingyu (2006), Zhang Feng (2009), Li Yao, et al. (2011) and Song Fangxiu et al. (2014), the research hypothesis of the impact between venture capital and operating performance of startups is set as follows:

(1) About the relationship between venture capital and the profitability of the operating performance of startups

In order to ensure the objective neutrality of this study, the research hypothesis of positive and negative aspects is proposed. Since the weighted ROE and ROA indicators are examined for profitability, the research hypothesis is:

H1a: There is a positive correlation between venture capital and the weighted ROE of the operating performance of startups;

H1b: There is a negative correlation between venture capital and the weighted ROE of the operating performance of startups.

The regression equation to verify the research hypothesis is

$$ROE_i=\beta_0+\beta_1*VC_i+\beta_2*VCR_i+\beta_3*LNTA_i+\beta_4*GDPRYEAR2016_i+\beta_5*GDPRYEAR2017_i+\beta_6*INDUSTRY1_i+...+\beta_{38}*INDUSTRY33_i+\varepsilon_i\varepsilon \quad \text{(Equation 4-1);}$$

H2a: There is a positive correlation between venture capital and the ROA of the operating performance of startups;

H2b: There is a negative correlation between venture capital and the ROA of the operating performance of startups;

The regression equation to verify the research hypothesis is

$$ROA_i=\beta_0+\beta_1*VC_i+\beta_2*VCR_i+\beta_3*LNTA_i+\beta_4*GDPRYEAR2016_i+\beta_5*GDPRYEAR2017_i+\beta_6*INDUSTRY1_i+...+\beta_{38}*INDUSTRY33_i+\varepsilon_i\varepsilon \quad \text{(Equation 4-2).}$$

(2) About the relationship between venture capital and the solvency of the operating performance of startups

Similarly, since CR and QR indicators are examined for solvency, the research hypothesis is:

H3a: There is a positive correlation between venture capital and the CR of the operating performance of startups;

H3b: There is a negative correlation between venture capital and the CR of the operating performance of startups;

The regression equation to verify the research hypothesis is

$$CR_i=\beta_0+\beta_1*VC_i+\beta_2*VCR_i+\beta_3*LNTA_i+\beta_4*GDPRYEAR2016_i+\beta_5*GDPRYEAR2017_i+\beta_6*INDUSTRY1_i+...+\beta_{38}*INDUSTRY33_i+\varepsilon_i\varepsilon \quad \text{(Equation 4-3);}$$

H4a: There is a positive correlation between venture capital and the QR of the operating performance of startups;

H4b: There is a negative correlation between venture capital and the QR of the operating performance of startups;

The regression equation to verify the research hypothesis is

$$QR_i=\beta_0+\beta_1*VC_i+\beta_2*VCR_i+\beta_3*LNTA_i+\beta_4*GDPRYEAR2016_i+\beta_5*GDPRYEAR2017_i+\beta_6*INDUSTRY1_i+...+\beta_{38}*INDUSTRY33_i+\varepsilon_i\varepsilon \quad \text{(Equation 4-4).}$$

(3) About the relationship between venture capital and the operating capabilities of the operating performance of startups

Similarly, since the operational capabilities examine the I_TURNOVER and TAT indicators, the research hypothesis is:

H5a: There is a positive correlation between venture capital and the I_TURNOVER of the operating performance of startups;

H5b: There is a negative correlation between venture capital and the I_TURNOVER of the operating performance of startups;

The regression equation to verify the research hypothesis is

$$I\_TURNOVER_i=\beta_0+\beta_1*VC_i+\beta_2*VCR_i+\beta_3*LNTA_i+\beta_4*GDPRYEAR2016_i+\beta_5*GDPRYEAR2017_i+\beta_6*INDUSTRY1_i+...+\beta_{38}*INDUSTRY33_i+\varepsilon_i\varepsilon \quad \text{(Equation 4-5);}$$

H6a: There is a positive correlation between venture capital and the TAT of the operating performance of startups;

H6b: There is a negative correlation between venture capital and the TAT of the operating performance of startups;

The regression equation to verify the research hypothesis is

$$TAT_i=\beta_0+\beta_1*VC_i+\beta_2*VCR_i+\beta_3*LNTA_i+\beta_4*GDPRYEAR2016_i+\beta_5*GDPRYEAR2017_i+\beta_6*INDUSTRY1_i+...+\beta_{38}*INDUSTRY33_i+\varepsilon_i\varepsilon \quad \text{(Equation 4-6).}$$

4.2 Model analysis of the impact of venture capital on the operating performance of startups

Based on the research hypotheses and regression equations presented above, an empirical analysis of the impact of venture capital on the profitability, solvency, and operating capabilities of startups is respectively carried out as follows.

4.2.1 Impact of venture capital on profitability

4.2.1.1 Impact on weighted ROE

(1) Direct regression results

In the EViews software, regression is directly conducted to the weighted ROE of the sample companies and VC-free/VC. The results are shown in the following table (Table 4-3):

Table 4-3 Regression results for weighted ROE and VC

Dependent Variable: ROE				
Method: Least Squares				
Date: 05/05/20 Time: 03:13				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-6.324651	1.667913	-3.791956	0.0002
C	27.12471	1.473223	18.41181	0
R-squared	0.058839	Mean dependent var		22.19039
Adjusted R-squared	0.054747	S.D. dependent var		10.8213
S.E. of regression	10.52092	Akaike info criterion		7.553192
Sum squared resid	25458.64	Schwarz criterion		7.582905
Log likelihood	-874.1702	Hannan-Quinn criter.		7.565175
F-statistic	14.37893	Durbin-Watson stat		1.882996
Prob(F-statistic)	0.000191			

The results in Table 4-3 show that there is a negative correlation between VC and ROE. The regression coefficient of VC is -6.32, and the F statistics of VC, which refers to the T statistics, is 0.0002. This is the direct regression result between VC and ROE.

(2) Multiple regression with control variables

According to the regression equation of Equation 4-1, the data of 232 sample companies are input in the EViews software. The impact of venture capital on the weighted ROE is shown in the following table (Table 4-4).

Table 4-4 Multiple regression results of venture capital and weighted ROE

Dependent Variable: ROE				
Method: Least Squares				
Date: 05/05/20 Time: 03:32				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-5.071287	1.932808	-2.623792	0.0094
VCR	0.029240	0.057012	0.512871	0.6086
LNTA	-1.139844	1.150854	-0.990433	0.3232
GDPRYEAR2016	0.249051	0.234597	1.061612	0.2897
GDPRYEAR2017	0.907682	0.420961	2.156212	0.0323
INDUSTRY1	4.397364	10.67525	0.411921	0.6809
INDUSTRY10	1.067643	10.44366	0.102229	0.9187
INDUSTRY11	41.71251	10.52735	3.962298	0.0001
INDUSTRY12	-10.15292	7.545395	-1.345579	0.1800
INDUSTRY13	-3.664531	10.45298	-0.350573	0.7263
INDUSTRY14	-8.383231	10.42762	-0.803945	0.4224
INDUSTRY15	-2.990954	10.44018	-0.286485	0.7748
INDUSTRY16	-3.090755	10.44173	-0.296000	0.7675
INDUSTRY17	-4.034709	7.468480	-0.540232	0.5897
INDUSTRY18	-6.815118	3.633949	-1.875403	0.0622
INDUSTRY19	-3.287678	2.402403	-1.368495	0.1727
INDUSTRY2	-1.852695	3.312971	-0.559225	0.5767
INDUSTRY20	-7.607782	7.544462	-1.008393	0.3145
INDUSTRY21	-1.799685	5.377954	-0.334641	0.7383

INDUSTRY22	-5.001453	3.796004	-1.317557	0.1892
INDUSTRY23	-9.649696	7.498010	-1.286968	0.1996
INDUSTRY24	5.199165	7.459786	0.696959	0.4867
INDUSTRY25	2.757243	6.156569	0.447854	0.6548
INDUSTRY26	-0.537970	3.595908	-0.149606	0.8812
INDUSTRY27	-15.36047	10.60575	-1.448315	0.1492
INDUSTRY28	-14.54995	10.70618	-1.359024	0.1757
INDUSTRY29	-6.566829	2.929685	-2.241479	0.0261
INDUSTRY3	6.507918	7.448084	0.873771	0.3833
INDUSTRY30	-2.988519	3.965478	-0.753634	0.4520
INDUSTRY31	-4.565140	7.516802	-0.607325	0.5443
INDUSTRY32	0.930009	5.457845	0.170399	0.8649
INDUSTRY33	1.187679	2.868128	0.414095	0.6793
INDUSTRY4	-2.854002	4.491526	-0.635419	0.5259
INDUSTRY5	-4.203917	10.44896	-0.402329	0.6879
INDUSTRY6	-6.162946	10.42963	-0.590907	0.5553
INDUSTRY7	-2.030774	2.857527	-0.710675	0.4781
INDUSTRY8	-15.11353	10.61961	-1.423171	0.1563
INDUSTRY9	3.246106	6.221283	0.521774	0.6024
C	49.47942	22.99562	2.151689	0.0327
R-squared	0.247535	Mean dependent var		22.19039
Adjusted R-squared	0.099381	S.D. dependent var		10.82130
S.E. of regression	10.26952	Akaike info criterion		7.648397
Sum squared resid	20354.36	Schwarz criterion		8.227806
Log likelihood	-848.2141	Hannan-Quinn criter.		7.882067
F-statistic	1.670797	Durbin-Watson stat		2.089955
Prob(F-statistic)	0.013492			

According to the regression results in Table 4-4, the R^2 value of the regression equation containing dummy variables and control variables is 0.2475, the R value is about 0.5, which is believed in statistics that the variables are moderately correlated when |R| is greater than or

equal to 0.5 and less than 0.8, and the Prob value of F statistics is 0.0135, which is far lower than 5%, and the equation has a high fitness.

After the regression equations are generally tested and combined with the coefficients of explaining variables, Equation 4-1 can be rewritten as regression equation with coefficients. Because there are too many dummy variables to express industrial fixed effects, which is omitted here.

(3) The economic significance test of multiple regression

It can be seen from Table 4-4 that the coefficient β_1 of the dummy variable VC, “venture or venture-free investment”, is -5.0713, which indicates that when other factors remain unchanged, the ROE of the VC startups has decreased by 5.41 units. In other words, there is a negative correlation between venture capital and ROE. Therefore, the H1a “There is a positive correlation between venture capital and the weighted ROE of the operating performance of startups” is denied, and the H1b “There is a negative correlation between venture capital and the weighted ROE of the operating performance of startups” is affirmed.

However, the regression equation only reveals the mathematical relationship between venture capital and weighted ROE, and cannot conclude that the ROE of startups will decline due to the introduction of venture capital. According to the adverse selection hypothesis, if venture capital tends to invest in startups with worse operating performance, it will inevitably lead to a lower ROE of startups. Based on a large number of practical observations, the adverse selection

hypothesis is accepted in this study, and it is believed that venture capital tends to invest in startups with worse operating performance, which has caused the venture-invested startups to have a generally low weighted ROE.

(4) The statistical significance test of multiple regression

For the regression equation in Table 4-4, The Prob value of the overall F statistics is 0.0135, which is lower than 5%, and the regression equation has statistical significance.

The T statistics of single variable is examined. The T statistics of the dummy variable VC, “venture or venture-free investment”, is -2.6238, and the Prob value is 0.0094, which is significantly lower than 5%. Therefore, the multiple regression passes the T test.

For the control variable VCR, the T statistics is 0.5129, and the Prob. value is 0.6086, which is significantly greater than 5%. Therefore, the multiple regression fails the T test. That is to say, the explanation of VCR on the weighted ROE is not significant.

For the control variable LNTA that represents the company size, the T statistic is -0.9904, and the Prob. value is 0.3232, which significantly greater than 5%. Therefore, the multiple regression fails the T test.

Among control sub-dumb variables GDPRYEAR2016 and GDPRYEAR2017 that represent the annual GDP growth rate fails the T test, GDPRYEAR2016 fails the T test and GDPRYEAR2017 passes the T test.

Among the control sub-dumb variables industry1 to industry33 that represent the industry growth rate, only industry11 and industry29 pass the T test, and the remaining fail the T test.

Some of the control variables participating in the regression and the controlled sub-dummy variables can pass the test, while others cannot, indicating that the impact of the control variable on the weighted ROE is local and limited, not as significant as the dummy variable VC. On the other hand, it also shows that there are other factors that affect the weighted ROE. From practical observations, such factors are too many to be processed in multiple regression equations. This is also the reason for the moderate level of the goodness of fit of the multiple regression equation.

The purpose of introducing control variables is to investigate the explained variables by putting the explaining variables under certain conditions. But the control variable is not the focus of this paper, it doesn’t merit any additional discussion here.

(5) The econometric significance test of multiple regression

EViews software is applied to examine the multicollinearity of the explaining variables for the multiple regression equations in Table 4-4. The results are as follows (Table 4-5).

Table 4-5 Collinearity diagnosis of multiple regression equation

	VC	VCR	LNTA	ISM	GDPR
VC	1.000000	0.398401	0.062127	0.005939	0.032346
VCR	0.398401	1.000000	0.078594	-0.008490	-0.103125

LNTA	0.062127	0.078594	1.000000	0.124830	-0.023697
ISM	0.005939	-0.008490	0.124830	1.000000	-0.048382
GDPR	0.032346	-0.103125	-0.023697	-0.048382	1.000000

According to Table 4-5, the explaining variables of multiple regression have a low correlation, and the correlation coefficient is lower than 0.4. Therefore, there is no multiple collinearity problem, and the multiple regression passes the econometric significance test. The multiple regression equation effectively explains the correlation between VC and ROE.

4.2.1.2 Impact on ROA

(1) Direct regression results

Regression is directly conducted to the ROA of the sample companies and VC in EViews software. The results are shown in the following table (Table 4-6):

Table 4-6 Regression results of ROA and VC

Dependent Variable: ROA				
Method: Least Squares				
Date: 05/05/20 Time: 03:13				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-4.903461	1.362225	-3.599596	0.0004
C	21.17069	1.203218	17.59506	0.0000
R-squared	0.053331	Mean dependent var		17.34515
Adjusted R-squared	0.049215	S.D. dependent var		8.812277

S.E. of regression	8.592694	Akaike info criterion	7.148285
Sum squared resid	16981.91	Schwarz criterion	7.177998
Log likelihood	-827.2011	Hannan-Quinn criter.	7.160268
F-statistic	12.95709	Durbin-Watson stat	2.126774
Prob(F-statistic)	0.000390		

The results in Table 4-6 indicate VC is a negative correlated with ROA. The regression coefficient of VC is -4.90, and the F statistic value of VC, that is, the T statistic value is 0.0004, which passes the test. That is, without considering other control factors or conditions, the ROA of VC startups is generally lower intuitively.

(2) Multiple regression with control variables

According to the regression equation of Equation 4-2, the impact of venture capital on ROA is shown in the following table (Table 4-7).

Table 4-7 Multiple regression results of venture capital and ROA

Dependent Variable: ROA				
Method: Least Squares				
Date: 05/05/20 Time: 03:34				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-3.005243	1.473002	-2.040217	0.0427
VCR	-0.015433	0.043449	-0.355195	0.7228
LNTA	-2.932429	0.877071	-3.343433	0.0010
GDPRYEAR2016	0.154522	0.178787	0.864278	0.3885
GDPRYEAR2017	0.417521	0.320817	1.301433	0.1947
INDUSTRY1	6.746788	8.135657	0.829286	0.4080
INDUSTRY10	5.769062	7.959163	0.724833	0.4694
INDUSTRY11	43.93288	8.022944	5.475905	0.0000

INDUSTRY12	-6.661921	5.750379	-1.158519	0.2481
INDUSTRY13	-5.132185	7.966262	-0.644240	0.5202
INDUSTRY14	-7.835751	7.946936	-0.986009	0.3254
INDUSTRY15	-6.284090	7.956511	-0.789805	0.4306
INDUSTRY16	-1.481820	7.957690	-0.186212	0.8525
INDUSTRY17	-5.827370	5.691762	-1.023825	0.3072
INDUSTRY18	-5.948980	2.769449	-2.148074	0.0330
INDUSTRY19	-2.494427	1.830882	-1.362418	0.1747
INDUSTRY2	-0.183433	2.524830	-0.072651	0.9422
INDUSTRY20	-6.212247	5.749668	-1.080453	0.2813
INDUSTRY21	-1.116449	4.098563	-0.272400	0.7856
INDUSTRY22	-4.899405	2.892952	-1.693566	0.0920
INDUSTRY23	-9.638324	5.714267	-1.686712	0.0933
INDUSTRY24	7.842172	5.685136	1.379417	0.1694
INDUSTRY25	-2.532193	4.691948	-0.539689	0.5900
INDUSTRY26	-0.507217	2.740457	-0.185085	0.8534
INDUSTRY27	-10.84401	8.082690	-1.341633	0.1813
INDUSTRY28	-4.385467	8.159225	-0.537486	0.5916
INDUSTRY29	-6.074383	2.232726	-2.720613	0.0071
INDUSTRY3	2.246629	5.676218	0.395797	0.6927
INDUSTRY30	-2.156614	3.022108	-0.713612	0.4763
INDUSTRY31	-5.340899	5.728588	-0.932324	0.3523
INDUSTRY32	3.689343	4.159448	0.886979	0.3762
INDUSTRY33	-0.166107	2.185813	-0.075993	0.9395
INDUSTRY4	2.148467	3.423012	0.627654	0.5310
INDUSTRY5	-8.126799	7.963197	-1.020545	0.3087
INDUSTRY6	-1.911618	7.948470	-0.240501	0.8102
INDUSTRY7	-0.552038	2.177734	-0.253492	0.8002
INDUSTRY8	-10.18876	8.093255	-1.258920	0.2096
INDUSTRY9	5.284616	4.741267	1.114600	0.2664
C	79.80389	17.52506	4.553701	0.0000
R-squared	0.340981	Mean dependent var		17.34515
Adjusted R-squared	0.211226	S.D. dependent var		8.812277

S.E. of regression	7.826446	Akaike info criterion		7.105054
Sum squared resid	11821.88	Schwarz criterion		7.684462
Log likelihood	-785.1862	Hannan-Quinn criter.		7.338723
F-statistic	2.627878	Durbin-Watson stat		2.352788
Prob(F-statistic)	0.000009			

According to the regression results in Table 4-7, the R^2 value of the regression equation containing dummy variables and control variables is 0.3410, the R value is about 0.58, which is believed in statistics that the variables are moderately correlated when |R| is greater than or equal to 0.5 and less than 0.8, and the Prob value of F statistics is 0.0000, the significance is 0, and the equation has a high fitness.

After the regression equations are generally tested and combined with the regression coefficients of explaining variables, Equation 4-2 can be rewritten as regression equation with coefficients, which is omitted here.

(3) The economic significance test of multiple regression

It can be seen from Table 4-7 that the regression coefficient β_1 of the dummy variable VC, “venture or venture-free investment”, is -3.0052, which indicates that when other factors remain unchanged, the ROA of the VC startups has decreased by 3.0052 units on the whole. In other words, there is a negative correlation between venture capital and ROE. Therefore, the H2a “There is a positive correlation between venture capital and the ROA of the operating performance of startups” is denied, and the H2b “There is a negative correlation between venture capital and the ROA of the operating performance of startups” is affirmed.

According to the adverse selection hypothesis, if venture capital tends to invest in startups with worse operating performance, it will inevitably lead to a lower ROA of startups.

(4) The statistical significance test of multiple regression

For the regression equation in Table 4-7, The Prob value of F statistics is 0 significantly, and the regression equation has statistical significance.

The T statistics of single variable is examined. The T statistics of the dummy variable VC, “venture or venture-free investment”, is -2.0402, and the Prob value is 0.0427, which is lower than 5%. Therefore, the multiple regression passes the T test.

For the control variable VCR, the T statistics is -0.3552, and the Prob. value is 0.7228, which is significantly greater than 5%. Therefore, the multiple regression fails the T test. That is to say, the explanation of VCR on the ROA is not significant.

For the control variable LNTA that represents the company size, the T statistic is -3.3434, and the Prob. value is 0.0010, which is significantly lower than 5%. Therefore, the multiple regression passes the T test, indicating that the explanation of LNTA on RA is very significant.

The control sub-dumb variables GDPRYEAR2016 and GDPRYEAR2017 that represent the annual GDP growth rate all fail the T test.

Among the control sub-dumb variables industry1 to industry33 that represent the industry growth rate, only industry11 and industry29 pass the T test, and the remaining fail the T test.

Some of the control variables participating in the regression and the controlled sub-dummy variables can pass the test, while others cannot, indicating that the impact of the control variable on the ROA is local and limited, not as significant as the dummy variable VC. In general, there are other unknown factors for the impact of ROA, which is also the reason for the moderate level of goodness of fit of the multiple regression equation. But the control variables are not the focus of this paper, which is simply observed and discussed here.

(4) The econometric significance test of multiple regression

For the multiple regression equation in Table 4-7, the multicollinearity result of explaining variables is the same as that in Table 4-5, and the explaining variables of multiple regression have a low correlation. Therefore, there is no multiple collinearity problem, and the multiple regression passes the econometric significance test. The regression equation effectively explains the correlation between VC and ROE.

4.2.2 Impact of venture capital on solvency

4.2.2.1 The impact on CR

(1) Direct regression results

Regression is directly conducted to the CR of the sample companies and VC in EViews software. The results are shown in the following table (Table 4-8):

Table 4-8 Regression results of venture capital and CR

Dependent Variable: CR				
Method: Least Squares				
Date: 05/05/20 Time: 03:14				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-0.449077	0.337480	-1.330678	0.1846
C	3.106001	0.298087	10.41977	0.0000
R-squared	0.007640	Mean dependent var		2.755644
Adjusted R-squared	0.003325	S.D. dependent var		2.132317
S.E. of regression	2.128769	Akaike info criterion		4.357548
Sum squared resid	1042.281	Schwarz criterion		4.387261
Log likelihood	-503.4756	Hannan-Quinn criter.		4.369531
F-statistic	1.770705	Durbin-Watson stat		1.995191
Prob(F-statistic)	0.184613			

The results in Table 4-8 show that VC and CR is not statistically correlated. The F statistics of explaining variable VC of the regression equation, which refers to the T statistics, is 0.1846, which fails the test. If only VC coefficient is observed, its value is -0.4491. The CR of VC startups is lower, but very slight.

That is, without considering other control factors or conditions, the CR of VC startups is slightly lower intuitively, but is not statistically significant.

(2) Multiple regression with control variables

According to the regression equation of Equation 4-3, the impact of venture capital on CR is shown in the following table (Table 4-9).

Table 4-9 Multiple regression results of venture capital and CR

Dependent Variable: CR				
Method: Least Squares				
Date: 05/05/20 Time: 03:36				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	0.057314	0.387948	0.147736	0.8827
VCR	-0.014936	0.011443	-1.305194	0.1934
LNTA	-0.790065	0.230996	-3.420247	0.0008
GDPRYEAR2016	-0.005528	0.047088	-0.117403	0.9067
GDPRYEAR2017	0.047042	0.084494	0.556743	0.5783
INDUSTRY1	0.565542	2.142708	0.263938	0.7921
INDUSTRY10	2.991847	2.096225	1.427255	0.1551
INDUSTRY11	5.558284	2.113023	2.630489	0.0092
INDUSTRY12	0.006210	1.514492	0.004101	0.9967
INDUSTRY13	-1.192024	2.098094	-0.568146	0.5706
INDUSTRY14	-0.015477	2.093004	-0.007394	0.9941
INDUSTRY15	-0.579852	2.095526	-0.276709	0.7823
INDUSTRY16	-0.542897	2.095837	-0.259036	0.7959
INDUSTRY17	-0.250168	1.499054	-0.166884	0.8676
INDUSTRY18	-0.785468	0.729397	-1.076873	0.2829
INDUSTRY19	0.101434	0.482204	0.210355	0.8336
INDUSTRY2	0.495719	0.664971	0.745474	0.4569
INDUSTRY20	-0.376342	1.514305	-0.248525	0.8040
INDUSTRY21	1.217193	1.079449	1.127606	0.2609
INDUSTRY22	-0.002869	0.761924	-0.003765	0.9970

INDUSTRY23	-1.243353	1.504981	-0.826159	0.4097
INDUSTRY24	2.230207	1.497309	1.489477	0.1380
INDUSTRY25	-1.224711	1.235730	-0.991083	0.3229
INDUSTRY26	-0.461628	0.721761	-0.639585	0.5232
INDUSTRY27	-0.310580	2.128758	-0.145897	0.8842
INDUSTRY28	-0.017975	2.148916	-0.008365	0.9933
INDUSTRY29	-0.585997	0.588039	-0.996528	0.3202
INDUSTRY3	-0.203888	1.494960	-0.136384	0.8917
INDUSTRY30	1.945655	0.795940	2.444474	0.0154
INDUSTRY31	-0.846700	1.508753	-0.561192	0.5753
INDUSTRY32	0.578722	1.095484	0.528280	0.5979
INDUSTRY33	1.174949	0.575683	2.040965	0.0426
INDUSTRY4	0.749159	0.901527	0.830989	0.4070
INDUSTRY5	-0.583215	2.097287	-0.278081	0.7812
INDUSTRY6	0.273511	2.093409	0.130653	0.8962
INDUSTRY7	0.355529	0.573555	0.619869	0.5361
INDUSTRY8	-1.082612	2.131541	-0.507901	0.6121
INDUSTRY9	0.171008	1.248719	0.136947	0.8912
C	18.63568	4.615620	4.037525	0.0001
R-squared	0.219250	Mean dependent var		2.755644
Adjusted R-squared	0.065528	S.D. dependent var		2.132317
S.E. of regression	2.061271	Akaike info criterion		4.436682
Sum squared resid	820.0255	Schwarz criterion		5.016090
Log likelihood	-475.6551	Hannan-Quinn criter.		4.670351
F-statistic	1.426271	Durbin-Watson stat		2.149036
Prob(F-statistic)	0.063923			

According to the regression results in Table 4-9, the F statistical probability value of the regression equation containing dummy variables and control variables is 0.0639, which is greater than 5%. The overall regression equation fails the test, and the impact relationship between VC and CR has no statistical significance.

(3) The economic significance test of multiple regression

It can be found through examining Table 4-9 that the value of the coefficient β_1 of the dummy variable VC is 0.0573, which is different from the direct regression for CR and VC. After adding the control variable, the value of VC coefficient β_1 changes from negative to positive, but is very slight. Neither of them can pass the F test and T test.

In view of this result, the H3a “There is a positive correlation between venture capital and the CR of the operating performance of startups” and the H3b “There is a negative correlation between venture capital and the CR of the operating performance of startups” cannot be verified.

(4) The statistical significance test of multiple regression

For the regression equation in Table 4-9, The Prob value of F statistics is greater than 5%, and the regression equation has no statistical significance.

The dummy variable VC, “venture or venture-free investment” is examined. The T statistics is 0.1477, and the Prob value is 0.8827, which is significantly greater than 5%. Therefore, the regression equation fails the T test, which further indicates that it has no statistical significance.

(4) The econometric significance test of multiple regression

For the multiple regression equation in Table 4-9, the multicollinearity result of the explaining variables is the same as that in Table 4-5, and the explaining variables of multiple regression have a low correlation. Therefore, there is no multiple collinearity problem, indicating that the insufficient significance of the regression results of VC and CR is not caused by the multicollinearity of the explaining variables.

4.2.2.2 The impact on QR

(1) Direct regression results

Regression is directly conducted to the QR of the sample companies and VC in EViews software. The results are shown in the following table (Table 4-10):

Table 4-10 Regression results of venture capital and QR

Dependent Variable: QR				
Method: Least Squares				
Date: 05/10/20 Time: 04:00				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-0.419090	0.312280	-1.342032	0.1809
C	2.549101	0.275829	9.241611	0.0000
R-squared	0.007770	Mean dependent var		2.222139
Adjusted R-squared	0.003456	S.D. dependent var		1.973223
S.E. of regression	1.969810	Akaike info criterion		4.202335
Sum squared resid	892.4353	Schwarz criterion		4.232048
Log likelihood	-485.4709	Hannan-Quinn criter.		4.214318
F-statistic	1.801050	Durbin-Watson stat		2.047446
Prob(F-statistic)	0.180909			

The results in Table 4-10 show that VC and QR is not statistically correlated. The F statistics of explaining variable VC of the regression equation, which refers to the T statistics, is 0.1809, which fails the test. If only VC coefficient is observed, its value is -0.4190. The QR of VC startups is lower, but very slight.

That is, without considering other control factors or conditions, the QR of VC startups is slightly lower intuitively, but is not statistically significant.

(2) Multiple regression with control variables

According to the regression equation of Equation 4-4, the impact of venture capital on QR is shown in the following table (Table 4-11).

Table 4-11 Multiple regression results of venture capital and QR

Dependent Variable: QR				
Method: Least Squares				
Date: 05/10/20 Time: 04:02				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	0.008632	0.365034	0.023646	0.9812
VCR	-0.011848	0.010767	-1.100349	0.2726
LNTA	-0.676964	0.217353	-3.114588	0.0021
GDPRYEAR2016	-0.001769	0.044306	-0.039924	0.9682
GDPRYEAR2017	0.033955	0.079504	0.427083	0.6698
INDUSTRY1	0.217794	2.016151	0.108025	0.9141
INDUSTRY10	2.730380	1.972413	1.384284	0.1679
INDUSTRY11	5.142066	1.988219	2.586268	0.0104
INDUSTRY12	-0.184897	1.425039	-0.129749	0.8969

INDUSTRY13	-0.997508	1.974172	-0.505279	0.6139
INDUSTRY14	0.198344	1.969383	0.100714	0.9199
INDUSTRY15	-0.445627	1.971755	-0.226005	0.8214
INDUSTRY16	-0.757378	1.972048	-0.384057	0.7014
INDUSTRY17	-0.625382	1.410513	-0.443372	0.6580
INDUSTRY18	-0.594868	0.686315	-0.866756	0.3872
INDUSTRY19	0.068184	0.453723	0.150277	0.8807
INDUSTRY2	0.653903	0.625695	1.045083	0.2973
INDUSTRY20	-0.355606	1.424863	-0.249572	0.8032
INDUSTRY21	0.703490	1.015692	0.692622	0.4894
INDUSTRY22	-0.158745	0.716921	-0.221426	0.8250
INDUSTRY23	-0.971100	1.416090	-0.685761	0.4937
INDUSTRY24	1.520942	1.408871	1.079547	0.2817
INDUSTRY25	-1.015267	1.162743	-0.873165	0.3837
INDUSTRY26	-0.337450	0.679131	-0.496885	0.6198
INDUSTRY27	-0.142267	2.003025	-0.071026	0.9435
INDUSTRY28	0.247816	2.021992	0.122560	0.9026
INDUSTRY29	-0.425234	0.553307	-0.768532	0.4431
INDUSTRY3	-0.096026	1.406661	-0.068265	0.9456
INDUSTRY30	1.811901	0.748929	2.419324	0.0165
INDUSTRY31	-0.836876	1.419639	-0.589499	0.5562
INDUSTRY32	0.724570	1.030780	0.702933	0.4829
INDUSTRY33	1.033430	0.541681	1.907822	0.0579
INDUSTRY4	0.636394	0.848279	0.750217	0.4540
INDUSTRY5	-0.300092	1.973412	-0.152067	0.8793
INDUSTRY6	-0.216718	1.969763	-0.110022	0.9125
INDUSTRY7	0.302305	0.539679	0.560158	0.5760
INDUSTRY8	-0.863693	2.005643	-0.430631	0.6672
INDUSTRY9	0.376359	1.174965	0.320315	0.7491
C	15.82802	4.343002	3.644489	0.0003
R-squared	0.192797	Mean dependent var		2.222139
Adjusted R-squared	0.033865	S.D. dependent var		1.973223
S.E. of regression	1.939523	Akaike info criterion		4.314921

Sum squared resid	726.0178	Schwarz criterion		4.894330
Log likelihood	-461.5309	Hannan-Quinn criter.		4.548591
F-statistic	1.213082	Durbin-Watson stat		2.183938
Prob(F-statistic)	0.200406			

According to the regression results in Table 4-9, the F statistical probability value of the regression equation containing dummy variables and control variables is 0.2004, which is greater than 5%. The overall regression equation fails the test, and the impact relationship between VC and QR has no statistical significance.

(3) The economic significance test of multiple regression

It can be found through examining Table 4-11 that the value of the coefficient β_1 of the dummy variable VC, “venture and venture-free investment” is 0.0086, which is different from the direct regression for CR and VC. After adding the control variable, the value of VC coefficient β_1 changes from negative to positive, but is very slight. And neither of them can pass the F test and T test.

Therefore, the H4a “There is a positive correlation between venture capital and the QR of the operating performance of startups” and the H4b “There is a negative correlation between venture capital and the QR of the operating performance of startups” cannot be verified.

(4) The statistical significance test of multiple regression

For the regression equation in Table 4-11, The Prob value of F statistics is significantly greater than 5%, and the regression equation has no statistical significance.

The dummy variable VC, “venture or venture-free investment” is examined. The T statistics is 0.0236, and the Prob value is 0.9812, which is significantly greater than 5%. Therefore, the regression equation fails the T test, which further indicates that the impact of venture capital on QR has no statistical significance.

(4) The econometric significance test of multiple regression

For the multiple regression equation in Table 4-11, the multicollinearity result of the explaining variables is the same as that in Table 4-5, and the explaining variables of multiple regression have a low correlation. Therefore, there is no multiple collinearity problem, indicating that the insufficient significance of the regression results of VC and QR is not caused by the multicollinearity of the explaining variables.

4.2.3 The impact of venture capital on operational capabilities

4.2.3.1 The impact on I_TURNOVER

(1) Direct regression results

Regression is directly conducted to the I_TURNOVER of the sample companies and VC in EViews software. The results are shown in the following table (Table 4-12):

Table 4-12 Regression results of venture capital and I_TURNOVER

Dependent Variable: I_TURNOVER				
Method: Least Squares				
Date: 05/05/20 Time: 03:15				
Sample: 1 232				
Included observations: 232				

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-30.00407	21.20864	-1.414710	0.1585
C	41.60502	18.73304	2.220943	0.0273
R-squared	0.008627	Mean dependent var		18.19666
Adjusted R-squared	0.004316	S.D. dependent var		134.0703
S.E. of regression	133.7806	Akaike info criterion		12.63886
Sum squared resid	4116370.	Schwarz criterion		12.66858
Log likelihood	-1464.108	Hannan-Quinn criter.		12.65085
F-statistic	2.001404	Durbin-Watson stat		2.005917
Prob(F-statistic)	0.158506			

The results in Table 4-12 show that VC and I_TURNOVER is not statistically correlated. The F statistics of explaining variable VC of the regression equation, which refers to the T statistics, is 0.1585, which fails the test. If only VC coefficient β_1 is observed, its value is -30.0041. The CR of VC startups is lower.

Therefore, without considering other control factors or conditions, the I_TURNOVER of VC startups is slightly lower intuitively, but is not statistically significant.

(2) Multiple regression with control variables

According to the regression equation of Equation 4-5, the impact of venture capital on I_TURNOVER is shown in the following table (Table 4-13).

Table 4-13 Multiple regression results of venture capital and I_TURNOVER

Dependent Variable: I_TURNOVER		
Method: Least Squares		

Date: 05/05/20 Time: 03:35				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-29.31738	25.67355	-1.141929	0.2549
VCR	-0.056972	0.757293	-0.075231	0.9401
LNTA	-5.661690	15.28683	-0.370364	0.7115
GDPRYEAR2016	-2.114063	3.116158	-0.678420	0.4983
GDPRYEAR2017	2.539607	5.591643	0.454179	0.6502
INDUSTRY1	-3.053613	141.7997	-0.021535	0.9828
INDUSTRY10	9.852437	138.7235	0.071022	0.9435
INDUSTRY11	-11.38805	139.8352	-0.081439	0.9352
INDUSTRY12	14.49540	100.2257	0.144628	0.8852
INDUSTRY13	23.64615	138.8472	0.170303	0.8649
INDUSTRY14	1.070416	138.5104	0.007728	0.9938
INDUSTRY15	2.561223	138.6773	0.018469	0.9853
INDUSTRY16	1.588413	138.6978	0.011452	0.9909
INDUSTRY17	-2.175934	99.20405	-0.021934	0.9825
INDUSTRY18	3.179180	48.26986	0.065863	0.9476
INDUSTRY19	17.89712	31.91119	0.560841	0.5756
INDUSTRY2	18.25408	44.00629	0.414806	0.6787
INDUSTRY20	0.362895	100.2133	0.003621	0.9971
INDUSTRY21	-3.904540	71.43553	-0.054658	0.9565
INDUSTRY22	-1.323549	50.42244	-0.026249	0.9791
INDUSTRY23	-13.28432	99.59629	-0.133382	0.8940
INDUSTRY24	5.981519	99.08857	0.060365	0.9519
INDUSTRY25	-4.248885	81.77789	-0.051956	0.9586
INDUSTRY26	7.343418	47.76455	0.153742	0.8780
INDUSTRY27	27.20948	140.8765	0.193144	0.8470
INDUSTRY28	8.707703	142.2105	0.061231	0.9512
INDUSTRY29	2.273603	38.91510	0.058425	0.9535
INDUSTRY3	10.92855	98.93313	0.110464	0.9122

INDUSTRY30	230.8963	52.67356	4.383533	0.0000
INDUSTRY31	1.409575	99.84591	0.014118	0.9888
INDUSTRY32	167.8128	72.49671	2.314764	0.0217
INDUSTRY33	-7.783106	38.09743	-0.204295	0.8383
INDUSTRY4	-8.681676	59.66108	-0.145517	0.8845
INDUSTRY5	2.837011	138.7938	0.020440	0.9837
INDUSTRY6	11.79035	138.5371	0.085106	0.9323
INDUSTRY7	-0.248510	37.95662	-0.006547	0.9948
INDUSTRY8	-12.00814	141.0607	-0.085128	0.9322
INDUSTRY9	-4.625155	82.63749	-0.055969	0.9554
C	146.5242	305.4515	0.479697	0.6320
R-squared	0.135083	Mean dependent var		18.19666
Adjusted R-squared	-0.035212	S.D. dependent var		134.0703
S.E. of regression	136.4103	Akaike info criterion		12.82137
Sum squared resid	3591301.	Schwarz criterion		13.40078
Log likelihood	-1448.279	Hannan-Quinn criter.		13.05504
F-statistic	0.793228	Durbin-Watson stat		2.023523
Prob(F-statistic)	0.799617			

According to the regression results in Table 4-13, the F statistical probability value of the regression equation containing dummy variables and control variables is 0.7996, which is greater than 5%. The overall regression equation fails the test, and the impact relationship between VC and I_TURNOVER has no statistical significance.

(3) The economic significance test of multiple regression

It can be found through examining Table 4-13 that the value of the coefficient β_1 of the dummy variable VC, “venture and venture-free investment” is -29.3174. I_TURNOVER of venture capital startups is negatively correlated with dummy variable VC, but it cannot pass the F test and T test.

In view of this result, the H5a “There is a positive correlation between venture capital and the I_TURNOVER of the operating performance of startups” and the H5b “There is a negative correlation between venture capital and the I_TURNOVER of the operating performance of startups” cannot be verified.

(4) The statistical significance test of multiple regression

For the regression equation in Table 4-13, The Prob value of F statistics is significantly greater than 5%, and the overall regression equation has no statistical significance.

The dummy variable VC, “venture or venture-free investment” is examined. The T statistics is -1.1419, and the Prob value is 0.2459, which is significantly greater than 5%. Therefore, the regression equation fails the T test, which further indicates that the regression equation of venture capital and I_TURNOVER has no statistical significance.

(4) The econometric significance test of multiple regression

For the multiple regression equation in Table 4-13, the multicollinearity result of the explaining variables is the same as that in Table 4-5, and the explaining variables of multiple regression have a low correlation. Therefore, there is no multiple collinearity problem, indicating that the insufficient significance of the regression results of venture capital and I_TURNOVER is not caused by the multicollinearity of the explaining variables.

4.2.3.2 The impact on TAT

(1) Direct regression results

Regression is directly conducted to the TAT of the sample companies and VC in EViews software. The results are shown in the following table (Table 4-14):

Table 4-14 Regression results of venture capital and TAT

Dependent Variable: TAT				
Method: Least Squares				
Date: 05/05/20 Time: 03:16				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-0.049393	0.057909	-0.852947	0.3946
C	0.915355	0.051150	17.89560	0.0000
R-squared	0.003153	Mean dependent var		0.876819
Adjusted R-squared	-0.001181	S.D. dependent var		0.365066
S.E. of regression	0.365282	Akaike info criterion		0.832289
Sum squared resid	30.68912	Schwarz criterion		0.862002
Log likelihood	-94.54554	Hannan-Quinn criter.		0.844272
F-statistic	0.727518	Durbin-Watson stat		1.923444
Prob(F-statistic)	0.394576			

The results in Table 4-14 show that VC and TAT is not statistically correlated. The F statistics of explaining variable VC of the regression equation, which refers to the T statistics, is 0.3946, which fails the test. If only VC coefficient β_1 is observed, its value is -0.0494. The CR of VC startups is lower but is slight.

It can be seen that, without considering other control factors or conditions, the TAT of VC startups is lower intuitively but slight, and is not statistically significant.

(2) Multiple regression with control variables

According to the regression equation of Equation 4-6, the impact of venture capital on TAT is shown in the following table (Table 4-15).

Table 4-15 Multiple regression results of venture capital and TAT

Dependent Variable: TAT				
Method: Least Squares				
Date: 05/05/20 Time: 03:38				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-0.020248	0.066876	-0.302773	0.7624
VCR	0.000599	0.001973	0.303519	0.7618
LNTA	-0.103880	0.039820	-2.608723	0.0098
GDPRYEAR2016	0.009418	0.008117	1.160295	0.2474
GDPRYEAR2017	0.021670	0.014565	1.487740	0.1385
INDUSTRY1	0.772448	0.369369	2.091265	0.0378
INDUSTRY10	-0.163912	0.361356	-0.453604	0.6506
INDUSTRY11	0.407387	0.364252	1.118421	0.2648
INDUSTRY12	0.216145	0.261074	0.827907	0.4087
INDUSTRY13	0.428724	0.361678	1.185373	0.2373
INDUSTRY14	0.019501	0.360801	0.054050	0.9570
INDUSTRY15	0.634709	0.361235	1.757052	0.0805
INDUSTRY16	0.156848	0.361289	0.434134	0.6647
INDUSTRY17	-0.131502	0.258413	-0.508883	0.6114
INDUSTRY18	-0.231689	0.125736	-1.842660	0.0669
INDUSTRY19	-0.113928	0.083124	-1.370579	0.1721

INDUSTRY2	0.133430	0.114630	1.164005	0.2459
INDUSTRY20	-0.111232	0.261042	-0.426108	0.6705
INDUSTRY21	-0.148997	0.186080	-0.800718	0.4243
INDUSTRY22	0.037420	0.131344	0.284902	0.7760
INDUSTRY23	0.020947	0.259435	0.080741	0.9357
INDUSTRY24	-0.088016	0.258112	-0.341000	0.7335
INDUSTRY25	-0.110543	0.213020	-0.518930	0.6044
INDUSTRY26	0.029983	0.124420	0.240985	0.8098
INDUSTRY27	-0.079245	0.366964	-0.215949	0.8293
INDUSTRY28	-0.130345	0.370439	-0.351867	0.7253
INDUSTRY29	-0.122737	0.101369	-1.210797	0.2275
INDUSTRY3	0.128247	0.257707	0.497646	0.6193
INDUSTRY30	-0.013795	0.137207	-0.100545	0.9200
INDUSTRY31	-0.207955	0.260085	-0.799565	0.4249
INDUSTRY32	0.086381	0.188844	0.457420	0.6479
INDUSTRY33	-0.140816	0.099239	-1.418962	0.1575
INDUSTRY4	-0.281300	0.155409	-1.810064	0.0718
INDUSTRY5	-0.184400	0.361539	-0.510042	0.6106
INDUSTRY6	0.100416	0.360870	0.278261	0.7811
INDUSTRY7	0.053907	0.098872	0.545218	0.5862
INDUSTRY8	0.350920	0.367444	0.955031	0.3408
INDUSTRY9	0.610677	0.215259	2.836935	0.0050
C	2.964320	0.795660	3.725613	0.0003
R-squared	0.208472	Mean dependent var		0.876819
Adjusted R-squared	0.052628	S.D. dependent var		0.365066
S.E. of regression	0.355330	Akaike info criterion		0.920622
Sum squared resid	24.36812	Schwarz criterion		1.500031
Log likelihood	-67.79219	Hannan-Quinn criter.		1.154292
F-statistic	1.337692	Durbin-Watson stat		2.239825
Prob(F-statistic)	0.105722			

According to the regression results in Table 4-15, the F statistical probability value of the regression equation containing dummy

variables and control variables is 0.1057, which is greater than 5%. The overall regression equation fails the test, and the impact relationship between VC and TAT has no statistical significance.

(3) The economic significance test of multiple regression

It can be found through examining Table 4-15 that the value of the coefficient β_1 of the dummy variable VC, “venture and venture-free investment” is -0.0202. TAT of venture capital startups is negatively correlated with dummy variable VC in a very slight manner, but it cannot pass the F test and T test.

In view of this result, the H6a “There is a positive correlation between venture capital and the TAT of the operating performance of startups” and the H6b “There is a negative correlation between venture capital and the TAT of the operating performance of startups” cannot be verified.

(4) The statistical significance test of multiple regression

For the regression equation in Table 4-15, The Prob value of F statistics is greater than 5%, and the overall regression equation has no statistical significance.

The dummy variable VC, “venture or venture-free investment” is examined. The T statistics is -0.3028, and the Prob value is 0.7624, which is significantly greater than 5%. Therefore, the regression equation fails the T test, which further indicates that the regression equation of venture capital and TAT has no statistical significance.

(4) The econometric significance test of multiple regression

For the multiple regression equation in Table 4-15, the multicollinearity result of the explaining variables is the same as that in Table 4-5, and the explaining variables of multiple regression have a low correlation. Therefore, there is no multiple collinearity problem, indicating that the insufficient significance of the regression results of venture capital and TAT is not caused by the multicollinearity of the explaining variables.

4.3 Hypothesis verification and main conclusions

The above mainly uses the 232 sample companies of Chinese GEM listed companies from 2016 to 2018 to conduct an empirical analysis of the impact of venture capital on the operating performance of startups. The verification of relevant research hypothesis and conclusions are further discussed below.

4.3.1 About hypothesis verification

The research hypotheses in this chapter are mainly proposed from the two perspectives that venture capital has a positive or negative impact on the operating performance of startups. According to the previous analysis, the verification results are shown in the following table (Table 4-16).

Table 4-16 Hypothesis verification of the impact of venture capital on the operating performance of startups

Hypothesis	Prob (F-statistic)	VC Prob (t-statistic)	Validation results (Y/N)
H1a: There is a positive correlation between the venture capital and the weighted return on	0.0135	0.0094	Contrary conclusion

equity (ROE) of operating performance of startups.			
H1b: There is a negative correlation between the venture capital and the weighted return on equity (ROE) of operating performance of startups.	0.0135	0.0094	Y
H2a: There is a positive correlation between the venture capital and the total return on assets (ROA) of operating performance of startups.	0.0000	0.0427	Contrary conclusion
H2b: There is a negative correlation between the venture capital and the total return on assets (ROA) of operating performance of startups.	0.0000	0.0427	Y
H3a: There is a positive correlation between the venture capital and the current ratio (CR) of operating performance of startups.	0.0639	0.8827	N
H3b: There is a negative correlation between the venture capital and the current ratio (CR) of operating performance of startups.	0.0639	0.8827	N
H4a: There is a positive correlation between the venture capital and the quick ratio (QR) of operating performance of startups.	0.2004	0.9812	N
H4b: There is a negative correlation between the venture capital and the quick ratio (QR) of operating performance of startups.	0.2004	0.9812	N
H5a: There is a positive correlation between the venture capital and the inventory turnover rate (I_TURNOVER) of operating performance of startups.	0.7996	0.2549	N
H5b: There is a negative correlation between the venture capital and the inventory turnover rate (I_TURNOVER) of operating performance of startups.	0.7996	0.2549	N
H6a: There is a positive correlation between the venture capital and the total asset turnover (TAT) of operating performance of startups.	0.1057	0.7624	N
H6b: There is a negative correlation between the venture capital and the total asset turnover (TAT) of operating performance of startups.	0.1057	0.7624	N

4.3.2 Main conclusions

According to the summary results in Table 4-16, there is a negative correlation between venture capital and the profitability of the operating performance of startups, including the negative correlations of weighted

ROE and ROA.; there is no statistically significant correlation between venture capital and the solvency including CR and QR of the operating performance of startups; there is no statistically significant correlation between venture capital and the operating capabilities including I_TURNOVER and TAT of the operating performance of startups.

(1) There is a negative correlation between venture capital and the profitability of the operating performance of startups. Generally speaking, after being introduced to a startup, the venture capital will bring more resources to the startup. In addition to capital, it is likely to render assistance in governance structure, capital operation, human resources, strategic innovation, etc., which will further develop and expand the startup. But why are the ROEs of venture capital startups in the sample companies generally low? Based on the literature review and a large amount of practical observations in this paper, it's most likely due to the adverse selection. Adverse selection is an important phenomenon when venture capital is introduced to a startup. Venture capital tends to choose startups with poor profitability for investment. So even before the IPO, the profitability of these venture capital startups is still generally lower than that of startups without venture capital.

(2) There is no statistically significant correlation between venture capital and the solvency of the operating performance of startups. It may be believed that the startups will improve the solvency as the invested startups incorporate the venture capital. But it can still be considered in terms of adverse selection and purpose of capital: Firstly,

if the current liabilities of the invested startups are already high, but venture capital prefers such startups, then the current liabilities may be eased after the introduction of venture capital, but the current ratio of invested startups before the IPO is still generally lower than the average level; secondly, the introduction of many venture capitals into the invested startups has a clear purpose of capital, such as expanding reproduction, technological upgrading, market expansion, etc., and the invested startups may need to increase the debt ratio to complete these operating activities, which cannot improve the solvency.

Therefore, it is of realistic logical rationality that there is no statistically significant correlation between venture capital and the solvency of the operating performance of startups, which is also proved by empirical analysis.

(3) There is no statistically significant correlation between venture capital and the operating capabilities of the operating performance of startups. Venture capital can provide more capital and intellectual support to the invested startups, but it may not be able to promote the operating capabilities of the invested startups to exceed the average level. There are also two possible reasons: Firstly, venture capital has a preference for adverse selection and tends to invest in startups with poor operating capabilities. In this case, even if venture capital improves the operating capabilities of some invested companies, the operating capabilities represented by I_TURNOVER of the invested startups before the IPO are still generally below average; secondly, relatively speaking, venture capitals are of little help in improving the

business operations. They may be familiar with finance, capital, governance, etc., but generally not very familiar with business operations and mostly are “powerless”.

Therefore, it is of realistic logical rationality that there is no statistically significant correlation between venture capital and the operating capabilities of the operating performance of startups, which is in line with the results of empirical analysis.

(4) In general, the conclusions of the empirical analysis can be summarized as follows: Due to the prominent adverse selection effect, the operating performance of startups with venture capital is generally lower than that of startups without venture capital.

Why isn’t that the profitability of startups is reduced by the active entry of venture capital? It needs to be analyzed in terms of motivation and behavior: Firstly, the venture capital does not have the motivation to reduce the profitability of startups. Because it does no good to startups, venture capital and managers of venture capital, and it does not meet the hypothesis of rational man. Secondly, in terms of behavior, venture capital requires the invested startups to make some improvements according to modern enterprise management system, standards and methods, etc. These improvements are generally considered to have positive value for startups. Certainly, they may increase some costs or result in failures, but it is impossible for all invested sample companies to fail after absorbing venture capital; there is also a possible phenomenon that the entrepreneurs of the invested startups do not

want to make progress after absorbing venture capital, resulting a certain decline in performance, etc. But it is impossible for all invested startups to make no attempt to make progress, causing the decline in the profitability of invested startups.

Therefore, the most convincing explanation is that there is indeed an adverse selection between venture capital and the operating performance of startups. Venture capital prefers to invest in startups with poor operating performance, so that the profitability of invested startups before the IPO is still generally lower than startups without venture capital. During the investment process, instead of being reduced by the venture capital, the profitability of invested startups is generally low. This idea can also be extended to solvency and operating capabilities. From the perspective of direct regression between VC and solvency indicators and operating capability indicators, the regression coefficients of VC have negative correlations in different degrees. Although there is no statistical significance, it is evidence-based that venture capital tends to invest in startups with poor profitability, solvency and operating capabilities.

4.3.3 Comparison with the conclusions of other related studies

Before empirical analysis, the author used to think that there was a positive correlation between venture capital and operating performance of startups, as too many startups are chasing venture capital, and too much venture capital is rushing into startups. Intuitively, if there is a negative correlation between venture capital and operating

performance of startups, so what is venture capital needed? It is precisely because of such doubts that the author conducted an overall analysis of the relevant data of GEM listed companies and different segmentation analysis, as well as referred to a large number of previous studies to finally determine that due to the adverse selection, there is a certain negative correlation between venture capital and the operating performance of startups.

In related literatures, the relevant research conclusions on the impact of venture capital on the operating performance of startups are mainly divided into two groups:

One group insists that there is a negative correlation, which is the conclusion of most studies. For example, the research of Li Yao and Zhang Ziwei (2011) shows that the reason why private equity capital in the GEM market causes the increase of the IPO underpricing rate of the holding companies is that there is an “adverse selection” effect when private equity capital is introduced to companies. The research of Song Fangxiu and Li Chenchen (2014) shows that the income state profits of companies with the participation of venture capital institutions before IPO are worse than those of holding companies without venture capital, and the participation of venture capital has aggravated the degree of underpricing during IPO. The research results of Zhang Lingyu (2006) support the theory of adverse selection, that is, relatively low-qualified companies are more likely to seek the support of venture capital. Liu Yang (2015) believes that the IPO underpricing rate of private equity capital holding companies is generally higher, which is not due to the

grandstanding effect, but because of the adverse selection of companies during equity financing. The research of Xu Xinyang (2011) shows that due to the adverse selection, the operating performance of companies invested by private equity capital after listing is not as good as that of companies without the support of private equity capital. Sun Xiaoqin (2015) believes that there is no significant change in the operating performances of companies with PE and companies without PE in the first year of listing. Zhang Feng (2009) believes that China's startup investment has improved the capital structure of company, but provided insufficient value-added services, and there may be "adverse selection" in project selection. Tan Yi and Yang Ye (2011) concludes in empirical research that there is a long-term problem of information asymmetry during venture capital.

Another group insists that there is a positive correlation. Only a few related studies support the similar conclusions. The research conclusions of Zhan Zhenghua and Zhou Juanyan (2018) believe that the existence of private equity investment is more conducive to improve the operating performance of companies; from the perspective of private equity investment, the number of joint investments, shareholding ratio and reputation are all positively correlated with the operating performance of the invested companies. The research of Tang Zhixiang (2019) shows that in Chinese GEM market, private equity investment plays a significant role in promoting the operating performance. The reason may be that private equity investment meets the capital needs of companies and thus promotes the performance.

The more participation of private equity institutions, the better the operating performance. The joint investment of multiple private equity institutions will contribute to the scientific decision-making and improve the market competitiveness of the companies; and the shareholding ratio of private equity and whether the private equity investment has a state-owned background do not significantly affect the operating performance of companies. Zhang Yelin (2015) believes that private equity investment benefits to the improvement of the operating performance of SME.

Obviously, the research conclusions in this paper are highly consistent with the idea of negative correlation, that is, venture capital has a negative correlation with the operating performance due to the adverse selection. However, as a fact study on the relationship between venture capital and the operating performance of startups, why are completely opposite conclusions drawn? The author has conducted in-depth reflection and analysis on this problem (because the author used to be a supporter of positive correlation theory), and believes that there may be certain flaws in these studies that draw the conclusion of positive correlation: The first is about the research methods. Some studies have used factor analysis method and other methods to perform complex processing on the data, which distorts the data and conclusions after the extraction of principal components and orthogonal rotation, such as the master thesis *Research on the Impact of Private Equity Investment on the Operating Performance of Sample*. (Xu,2018) The second is that the sample size is reduced largely to replace the whole with parts,

which may distort the selective research conclusions. For example, in the article *Research on the Impact of Private Equity Investment on Operating Performance of Enterprises*, only 135 listed companies were selected as samples from more than 600 GEM companies (as of the time of writing), (Tang,2019) and conclusion of positive correlation was drawn, with flaws existing in the representativeness of the samples to a certain extent.

Through the empirical analysis in this chapter, this paper believes that the venture capital has a negative correlation with the operating performance of startups mainly due to the adverse selection.

4.4 The relationship between the venture capital and the valuation and growth of startups

The above found that there is a negative correlation between venture capital and the operating performance of startups. Next, he relationship between venture capital and the valuation and growth of startups will be further examined. In order to be consistent, the author still uses the 232 Chinese GEM-listed companies from 2016 to 2018 as a sample, and conducts new regression calculation separately to the price-to-earnings ratio (PE, market value/earnings) and price-to-book ratio (PB, market value/net assets), price-to-sales ration (PS, market value/sales) of the first day of listing (IPO cross-section data), and IPO annual growth rate of total operating income (TOIR-IPO) by the same method in this chapter to form a supplementary analysis of the adverse selection.

4.4.1 Descriptive statistics of new variables

Descriptive statistics have been carried out for the variables involved in the new calculation, including VC (whether there is venture capital), VCR (VC's shareholding ratio), LNTA (logarithm for total assets), PE (price-to-earnings ratio, market value/earnings), PB (market-to-book ratio, market value/net assets), PS (market-to-sales ratio, market value/sales), TOIR_IPO (IPO annual growth rate of total operating income), and the results are as follows:

Table 4-17 Descriptive statistical results of new variables

	VC	VCR	LNTA	PE	PB	PS	TOIR_IPO
Mean	0.780172	10.83816	20.21308	29.56739	6.260250	5.337065	18.63688
Median	1.000000	6.520000	20.07497	30.52773	5.695021	4.637326	14.84384
Maximum	1.000000	81.73000	24.62852	33.10646	18.33300	18.68675	95.34728
Minimum	0.000000	0.000000	18.96903	11.83322	1.524919	1.054339	-22.30648
Std. Dev.	0.415025	14.47167	0.731486	3.363969	2.609612	2.930583	20.22859
Observations	232	232	232	232	232	232	232

From the results in the table, all variables are at a normal level. In addition, the sub-dummy variables such as GDP growth rate and industry growth rate involved in the calculation are consistent with the above, so the descriptive statistics are omitted.

4.4.2 Calculation results of new variables

(1) About PE. In the unary regression, there is no statistically linear relationship between the price-to-earnings ratio (PE) and the presence or absence of VC. Its F test and T test prob. values are all 0.7944, which is much greater than 5% (Table 4-18).

Table 4-18 Unary regression results of PE and the presence or absence of VC

Dependent Variable: PE				
Method: Least Squares				
Date: 10/28/20 Time: 11:38				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-0.139440	0.534379	-0.260939	0.7944
C	29.67618	0.472003	62.87288	0.0000
R-squared	0.000296	Mean dependent var		29.56739
Adjusted R-squared	-0.004051	S.D. dependent var		3.363969
S.E. of regression	3.370775	Akaike info criterion		5.276746
Sum squared resid	2613.289	Schwarz criterion		5.306459
Log likelihood	-610.1025	Hannan-Quinn criter.		5.288729
F-statistic	0.068089	Durbin-Watson stat		1.861854
Prob(F-statistic)	0.794373			

The multiple regression results after adding controls variables such as VCR, LNTA, sub-dummy variables that characterize annual GDP growth rates (GDPRYEAR2016, GDPRYEAR2017), and sub-dummy variables that characterize industry sales profit rates (INDUSTRY1-INDUSTRY33) cannot pass the F test and T test (Table 4-19):

Table 4-19 Multiple regression results of PE and the presence or absence of VC

Dependent Variable: PE		
Method: Least Squares		
Date: 10/28/20 Time: 11:51		

Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-0.142967	0.618745	-0.231059	0.8175
VCR	0.004345	0.018251	0.238085	0.8121
LNTA	-0.419559	0.368420	-1.138807	0.2562
GDPRYEAR2016	0.085438	0.075101	1.137637	0.2567
GDPRYEAR2017	-0.162721	0.134761	-1.207475	0.2287
INDUSTRY1	-5.141564	3.417442	-1.504507	0.1341
INDUSTRY10	-0.378614	3.343304	-0.113245	0.9100
INDUSTRY11	-7.100030	3.370096	-2.106774	0.0364
INDUSTRY12	-0.489267	2.415489	-0.202554	0.8397
INDUSTRY13	4.107601	3.346286	1.227510	0.2211
INDUSTRY14	4.281334	3.338168	1.282540	0.2012
INDUSTRY15	2.815549	3.342190	0.842426	0.4006
INDUSTRY16	-2.172547	3.342685	-0.649941	0.5165
INDUSTRY17	3.319707	2.390866	1.388496	0.1666
INDUSTRY18	-0.574951	1.163327	-0.494229	0.6217
INDUSTRY19	0.528974	0.769075	0.687805	0.4924
INDUSTRY2	-0.683438	1.060573	-0.644405	0.5201
INDUSTRY20	2.889749	2.415190	1.196489	0.2330
INDUSTRY21	3.023156	1.721631	1.755984	0.0807
INDUSTRY22	0.162632	1.215205	0.133831	0.8937
INDUSTRY23	1.899123	2.400319	0.791196	0.4298
INDUSTRY24	3.359266	2.388083	1.406679	0.1611
INDUSTRY25	2.644292	1.970887	1.341676	0.1813
INDUSTRY26	1.096410	1.151149	0.952448	0.3421
INDUSTRY27	-3.316403	3.395193	-0.976794	0.3299

INDUSTRY28	4.524189	3.427342	1.320029	0.1884
INDUSTRY29	0.496885	0.937873	0.529800	0.5969
INDUSTRY3	2.119761	2.384337	0.889036	0.3751
INDUSTRY30	1.119940	1.269459	0.882219	0.3788
INDUSTRY31	2.880455	2.406335	1.197030	0.2328
INDUSTRY32	2.775086	1.747206	1.588299	0.1139
INDUSTRY33	2.013807	0.918167	2.193291	0.0295
INDUSTRY4	1.067527	1.437861	0.742441	0.4587
INDUSTRY5	3.171875	3.344999	0.948244	0.3442
INDUSTRY6	2.761040	3.338813	0.826953	0.4093
INDUSTRY7	1.032866	0.914773	1.129095	0.2603
INDUSTRY8	2.032391	3.399631	0.597827	0.5507
INDUSTRY9	1.300666	1.991604	0.653075	0.5145
C	37.23411	7.361530	5.057931	0.0000
R-squared	0.202028	Mean dependent var		29.56739
Adjusted R-squared	0.044915	S.D. dependent var		3.363969
S.E. of regression	3.287555	Akaike info criterion		5.370325
Sum squared resid	2085.948	Schwarz criterion		5.949734
Log likelihood	-583.9577	Hannan-Quinn criter.		5.603995
F-statistic	1.285873	Durbin-Watson stat		1.941474
Prob(F-statistic)	0.139368			

(2) About PB. In the unary regression, there is a negative correlation between PB and the presence or absence of VC. The coefficient of VC is -1.3177, and the prob. values of F test and T test are all 0.0013, which is much lower than 5% (Table 4-20).

Table 4-20 Unary regression results of PB and the presence or absence of VC

Dependent Variable: PB		

Method: Least Squares				
Date: 10/28/20 Time: 11:59				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-1.317721	0.405401	-3.250412	0.0013
C	7.288300	0.358080	20.35381	0.0000
R-squared	0.043918	Mean dependent var		6.260250
Adjusted R-squared	0.039761	S.D. dependent var		2.609612
S.E. of regression	2.557205	Akaike info criterion		4.724290
Sum squared resid	1504.038	Schwarz criterion		4.754003
Log likelihood	-546.0176	Hannan-Quinn criter.		4.736273
F-statistic	10.56518	Durbin-Watson stat		2.003729
Prob(F-statistic)	0.001325			

After adding the control variables, the prob. value of the F test is 0.2456, so the overall equation cannot pass the test; the prob. value of the T test is 0.0305, which is less than 5%, so it can pass the test (Table 4-21). In other words, by adjusting the explanatory variables and other processing methods, it can be verified that there is a negative correlation between PB and VC:

Table 4-21 Multiple regression results of PB and the presence or absence of VC

Dependent Variable: PB				
Method: Least Squares				
Date: 10/28/20 Time: 11:52				
Sample: 1 232				
Included observations: 232				

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-1.055934	0.484453	-2.179643	0.0305
VCR	0.005928	0.014290	0.414810	0.6787
LNTA	-0.351642	0.288458	-1.219038	0.2243
GDPRYEAR2016	0.072919	0.058801	1.240100	0.2164
GDPRYEAR2017	0.179280	0.105513	1.699128	0.0909
INDUSTRY1	-0.597357	2.675721	-0.223251	0.8236
INDUSTRY10	0.487016	2.617674	0.186049	0.8526
INDUSTRY11	4.453525	2.638651	1.687803	0.0931
INDUSTRY12	-2.197011	1.891232	-1.161683	0.2468
INDUSTRY13	-0.670372	2.620009	-0.255866	0.7983
INDUSTRY14	-1.946997	2.613653	-0.744933	0.4572
INDUSTRY15	-0.431975	2.616802	-0.165077	0.8691
INDUSTRY16	-1.362520	2.617190	-0.520604	0.6032
INDUSTRY17	-0.843197	1.871953	-0.450437	0.6529
INDUSTRY18	-1.541830	0.910839	-1.692758	0.0921
INDUSTRY19	-0.812085	0.602155	-1.348630	0.1790
INDUSTRY2	-0.150155	0.830387	-0.180826	0.8567
INDUSTRY20	-1.743264	1.890998	-0.921875	0.3577
INDUSTRY21	-0.825806	1.347969	-0.612630	0.5408
INDUSTRY22	-1.122993	0.951458	-1.180287	0.2393
INDUSTRY23	-2.135109	1.879355	-1.136087	0.2573
INDUSTRY24	1.547468	1.869774	0.827623	0.4089
INDUSTRY25	0.860180	1.543126	0.557427	0.5779
INDUSTRY26	-0.016124	0.901304	-0.017889	0.9857
INDUSTRY27	-3.928182	2.658301	-1.477704	0.1411
INDUSTRY28	-3.091203	2.683473	-1.151941	0.2508
INDUSTRY29	-1.452791	0.734317	-1.978425	0.0493

INDUSTRY3	2.218813	1.866841	1.188539	0.2361
INDUSTRY30	-0.392009	0.993936	-0.394401	0.6937
INDUSTRY31	-0.697540	1.884065	-0.370231	0.7116
INDUSTRY32	0.498354	1.367993	0.364296	0.7160
INDUSTRY33	0.669641	0.718888	0.931496	0.3528
INDUSTRY4	-0.311053	1.125788	-0.276298	0.7826
INDUSTRY5	-0.549329	2.619001	-0.209747	0.8341
INDUSTRY6	-1.230283	2.614158	-0.470623	0.6384
INDUSTRY7	-0.307176	0.716231	-0.428879	0.6685
INDUSTRY8	-3.234939	2.661776	-1.215331	0.2257
INDUSTRY9	1.252574	1.559347	0.803269	0.4228
C	14.16150	5.763786	2.456978	0.0149
R-squared	0.187134	Mean dependent var		6.260250
Adjusted R-squared	0.027087	S.D. dependent var		2.609612
S.E. of regression	2.574025	Akaike info criterion		4.880979
Sum squared resid	1278.742	Schwarz criterion		5.460387
Log likelihood	-527.1935	Hannan-Quinn criter.		5.114648
F-statistic	1.169248	Durbin-Watson stat		1.921501
Prob(F-statistic)	0.245646			

(3) About PS. In the unary regression, there is a negative correlation between PS and the presence or absence of VC. The coefficient of VC is -1.3658, and the prob. values of F test and T test are all 0.0031, which is much lower than 5% (Table 4-22).

Table 4-22 Unary regression results of PS and the presence or absence of VC

Dependent Variable: PS		
Method: Least Squares		
Date: 10/28/20 Time: 12:00		

Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-1.365782	0.456811	-2.989821	0.0031
C	6.402610	0.403489	15.86813	0.0000
R-squared	0.037411	Mean dependent var		5.337065
Adjusted R-squared	0.033226	S.D. dependent var		2.930583
S.E. of regression	2.881486	Akaike info criterion		4.963073
Sum squared resid	1909.681	Schwarz criterion		4.992786
Log likelihood	-573.7164	Hannan-Quinn criter.		4.975056
F-statistic	8.939031	Durbin-Watson stat		2.110398
Prob(F-statistic)	0.003095			

After adding the control variables, the F test and T test cannot be passed (Table 4-23):

Table 4-23 Multiple regression results of PS and the presence or absence of VC

Dependent Variable: PS				
Method: Least Squares				
Date: 10/28/20 Time: 11:53				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	-0.746638	0.532192	-1.402949	0.1622
VCR	-0.018887	0.015698	-1.203151	0.2304
LNTA	-0.457533	0.316884	-1.443851	0.1504
GDPRYEAR2016	0.031256	0.064595	0.483869	0.6290

GDPRYEAR2017	0.029601	0.115910	0.255379	0.7987
INDUSTRY1	-1.360005	2.939393	-0.462682	0.6441
INDUSTRY10	2.687214	2.875626	0.934479	0.3512
INDUSTRY11	4.472821	2.898670	1.543060	0.1245
INDUSTRY12	-2.953108	2.077598	-1.421405	0.1568
INDUSTRY13	-2.358755	2.878191	-0.819527	0.4135
INDUSTRY14	-1.876719	2.871209	-0.653634	0.5141
INDUSTRY15	-3.158041	2.874668	-1.098576	0.2733
INDUSTRY16	-1.501249	2.875094	-0.522157	0.6022
INDUSTRY17	-0.325676	2.056420	-0.158370	0.8743
INDUSTRY18	-0.644336	1.000595	-0.643953	0.5204
INDUSTRY19	0.345114	0.661493	0.521720	0.6025
INDUSTRY2	0.144310	0.912215	0.158197	0.8745
INDUSTRY20	-0.466695	2.077341	-0.224660	0.8225
INDUSTRY21	0.966342	1.480801	0.652581	0.5148
INDUSTRY22	-1.121430	1.045217	-1.072916	0.2846
INDUSTRY23	-2.652286	2.064551	-1.284680	0.2004
INDUSTRY24	3.935817	2.054026	1.916148	0.0568
INDUSTRY25	-0.068210	1.695190	-0.040238	0.9679
INDUSTRY26	-0.357901	0.990121	-0.361472	0.7181
INDUSTRY27	-2.986415	2.920257	-1.022655	0.3078
INDUSTRY28	-0.766140	2.947909	-0.259893	0.7952
INDUSTRY29	-0.887847	0.806679	-1.100620	0.2724
INDUSTRY3	0.682582	2.050804	0.332836	0.7396
INDUSTRY30	1.424201	1.091880	1.304356	0.1937
INDUSTRY31	0.021989	2.069725	0.010624	0.9915
INDUSTRY32	0.893356	1.502798	0.594461	0.5529
INDUSTRY33	1.290051	0.789729	1.633536	0.1040

INDUSTRY4	3.874152	1.236726	3.132587	0.0020
INDUSTRY5	-0.969603	2.877084	-0.337009	0.7365
INDUSTRY6	-0.777185	2.871763	-0.270630	0.7870
INDUSTRY7	0.708424	0.786810	0.900375	0.3690
INDUSTRY8	-3.348491	2.924074	-1.145146	0.2536
INDUSTRY9	-0.675999	1.713009	-0.394627	0.6936
C	15.07582	6.331763	2.380983	0.0182
R-squared	0.222149	Mean dependent var		5.337065
Adjusted R-squared	0.068997	S.D. dependent var		2.930583
S.E. of regression	2.827676	Akaike info criterion		5.068947
Sum squared resid	1543.180	Schwarz criterion		5.648356
Log likelihood	-548.9979	Hannan-Quinn criter.		5.302617
F-statistic	1.450511	Durbin-Watson stat		2.110157
Prob(F-statistic)	0.055355			

(4) About TOIR-IPO. In the unary regression, there is no statistically significant linear relationship between the TOIR_IPO and the presence or absence of VC, and it cannot pass the F test and T test (Table 4-24).

Table 4-24 Unary regression results of TOIR_IPO and the presence or absence of VC

Dependent Variable: TOIR_IPO				
Method: Least Squares				
Date: 10/28/20 Time: 12:01				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	1.823871	3.211611	0.567899	0.5707

C	17.21395	2.836732	6.068231	0.0000
R-squared	0.001400	Mean dependent var		18.63688
Adjusted R-squared	-0.002941	S.D. dependent var		20.22859
S.E. of regression	20.25832	Akaike info criterion		8.863591
Sum squared resid	94391.87	Schwarz criterion		8.893305
Log likelihood	-1026.177	Hannan-Quinn criter.		8.875574
F-statistic	0.322509	Durbin-Watson stat		2.042257
Prob(F-statistic)	0.570658			

After adding the control variables, it still fails to pass the F test and T test (Table 4-25):

Table 4-25 Multiple regression results of TOIR_IPO and the presence or absence of VC

Dependent Variable: TOIR_IPO				
Method: Least Squares				
Date: 10/28/20 Time: 11:54				
Sample: 1 232				
Included observations: 232				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VC	2.927918	3.919523	0.747009	0.4560
VCR	-0.087893	0.115614	-0.760223	0.4480
LNTA	2.926904	2.333806	1.254133	0.2113
GDPRYEAR2016	1.150478	0.475737	2.418308	0.0165
GDPRYEAR2017	1.347594	0.853664	1.578600	0.1161
INDUSTRY1	-15.53095	21.64824	-0.717423	0.4740
INDUSTRY10	8.403266	21.17860	0.396781	0.6920
INDUSTRY11	17.91074	21.34832	0.838977	0.4025

INDUSTRY12	-11.22317	15.30123	-0.733481	0.4642
INDUSTRY13	-5.429907	21.19749	-0.256158	0.7981
INDUSTRY14	2.483310	21.14607	0.117436	0.9066
INDUSTRY15	-17.13446	21.17155	-0.809316	0.4193
INDUSTRY16	9.507167	21.17468	0.448987	0.6539
INDUSTRY17	-4.687594	15.14526	-0.309509	0.7573
INDUSTRY18	-3.471610	7.369250	-0.471094	0.6381
INDUSTRY19	4.410360	4.871810	0.905282	0.3664
INDUSTRY2	-3.290410	6.718341	-0.489765	0.6249
INDUSTRY20	-4.602292	15.29934	-0.300816	0.7639
INDUSTRY21	8.699969	10.90590	0.797730	0.4260
INDUSTRY22	-6.873593	7.697880	-0.892920	0.3730
INDUSTRY23	-8.017702	15.20514	-0.527302	0.5986
INDUSTRY24	8.764827	15.12763	0.579392	0.5630
INDUSTRY25	-4.150953	12.48485	-0.332479	0.7399
INDUSTRY26	6.432473	7.292106	0.882115	0.3788
INDUSTRY27	-10.71707	21.50730	-0.498299	0.6188
INDUSTRY28	12.40529	21.71095	0.571384	0.5684
INDUSTRY29	-6.001891	5.941080	-1.010236	0.3136
INDUSTRY3	-1.959231	15.10390	-0.129717	0.8969
INDUSTRY30	-1.156982	8.041553	-0.143875	0.8857
INDUSTRY31	1.148942	15.24325	0.075374	0.9400
INDUSTRY32	11.23301	11.06791	1.014917	0.3114
INDUSTRY33	-0.010767	5.816248	-0.001851	0.9985
INDUSTRY4	1.037996	9.108322	0.113961	0.9094
INDUSTRY5	-12.95300	21.18934	-0.611298	0.5417
INDUSTRY6	7.643152	21.15015	0.361376	0.7182
INDUSTRY7	-1.503967	5.794752	-0.259540	0.7955

INDUSTRY8	-11.65244	21.53541	-0.541083	0.5891
INDUSTRY9	10.30532	12.61608	0.816840	0.4150
C	-46.43332	46.63259	-0.995727	0.3206
R-squared	0.114470	Mean dependent var		18.63688
Adjusted R-squared	-0.059883	S.D. dependent var		20.22859
S.E. of regression	20.82546	Akaike info criterion		9.062389
Sum squared resid	83704.03	Schwarz criterion		9.641797
Log likelihood	-1012.237	Hannan-Quinn criter.		9.296058
F-statistic	0.656542	Durbin-Watson stat		2.132983
Prob(F-statistic)	0.937909			

4.4.3 The verification on adverse selection

Different from the operating performance of startups, PE, PB and PS mainly characterize the valuation of startups, while TOIR-IPO mainly characterizes the growth of startups. The above analysis on the valuation, growth of startups and the presence or absence of venture capital can form a supplementary verification of the adverse selection in the venture capital.

Although the results of the unary regression show that the PS and PB of startups with VC are generally lower, the multiple regression results of adding control variables indicate that there is no statistically correlation between PE, PB, PS, TOIR-IPO and the presence or absence of VC. By adjusting the explanatory variables and other processing methods, the negative correlation between PB and the presence or absence of VC can be verified. From the perspective of PE and TOIR-OPO, the conclusion cannot be drawn, and there is no

statistically significant correlation. Generally speaking, the presence or absence of VC does not have a significant influence on the valuation and growth of startups. The phenomenon of adverse selection between venture capital and startups is mainly reflected in operating performance.

Chapter 5 Cause and Effect Analysis of Adverse Selection in Venture capital

The empirical analysis in Chapter 4 points out that there is a negative correlation between venture capital and the operating performance of startups. In 5.1 of this chapter, the author will analyze the main causes that lead to the negative correlation between venture capital and the operating performance of startups. In chapter 5.2 of this chapter, the author will discuss the long-term and far-reaching effects of this negative correlation on venture capital and startups.

5.1 Cause of adverse selection for negative correlation between venture capital and operating performance of startups

Two aspects will be analyzed in this paper. Firstly, in the process of selecting invested companies and projects, venture capital is more inclined to startups with poor operating performance in some cases. Secondly, startups with poor operating performance may be more willing to attract venture capital investment.

5.1.1 Causes for venture capital to select the startups with poor operating performance

The process of venture capital is essentially the process of operating risk. For different invested projects: The lower the risk, the lower the return on investment, but the higher the probability of successful investment; on the contrary, the higher the risk, the higher the return on

investment, but the lower the probability of successful investment. If the invested projects are compared in terms of maturity, degree of risk, industry distribution, return on investment, and probability of successful investment, a list can be roughly formed as follows:

Table 5-1 Comparison of invested projects in the venture capital process

Project category	Project maturity	Degree of risk	Industry distribution	Return on investment	Probability of success
High-risk projects	Low	High	TMT, medicine, etc.	High	Low
Medium-risk projects	Medium	Medium	Converged and transformation industries	Medium	Medium
Low-risk projects	High	Low	Traditional industries	Low	High

The high-risk, medium-risk, and low-risk projects listed in Table 5-1 are not absolute. There may also be TMT and pharmaceutical industry projects with high maturity and low risk, as well as traditional industry projects with low maturity and high risks. However, such projects are generally not normal reserve investment projects for ordinary venture capital. Either they are difficult to invest, or they are not worth investing.

Due to the existence of reserve projects with different risk degrees in the market, different venture capitals will show different risk appetites based on their own risk tolerance, thus forming a variety of different types of venture capital, such as AI funds and biomedicine funds which contend for high risks and high returns, and real estate funds and Pre-IPO funds which contend for low risks and stable returns. These are all normal phenomena caused by different market positioning, which will help form a multi-level and diversified venture capital market.

In the analysis in Chapter 4, the fixed effects of the industry are controlled, so the results are not caused by the different risks of different industries.

In terms of time period, different venture capitals focus on the initial, early, middle and pre-IPO stages of startups, and also reflect their risk appetites. In general, the earlier the investment focus of venture capital is put, the worse the operating performance of startups for reserve investment, the greater the risk faced by venture capital and the higher the required return on investment; while those focus on the mid-to-late periods, the operating performance of startups for reserve investment is better, the risk faced by venture capital is lower, and the obtained return on investment is lower.

From the perspective of venture capital, startups with poor operating performance generally have low valuations, and they can obtain more equities at a lower capital cost. Once the IPOs of invested startups are successful, the wealth effect will be more considerable than investing in companies with good operating performance and high valuations. According to the analysis in Section 4.4 of this thesis, venture capital is generally more inclined to invest in startups with lower valuations. Once the project's IPO is successful, venture capital will play the role of "touching a stone and turning it into gold". For example, in 2010, Hillhouse invested in Jingdong which was unprofitable and had low valuation. At first, Liu Qiangdong only wanted USD 75 million, but Zhang Lei insisted on investing USD 300 million and raised the

valuation by several time, becoming a much-told story in the investment community[①].

Due to different investment fields, risk levels, and investment stages, some venture capitals have adversely selected startups with high probability of failure, high risk levels, and poor operating performance, which is entirely the result of market-based selection. It reflects that during IPO, the operating performance of invested companies does not reach the average operating performance of all IPO companies. This is a normal phenomenon, although there is also the effect of adverse selection.

In addition to the causes discussed above, information asymmetry refers to the fact that the information held by the transaction parties is not exactly the same, which may cause adverse selection. Generally speaking, in venture capital activities, risk fund managers cannot fully grasp the information of the invested companies, including financial information related to the operating performance, as well as the concealed information such as contingent debts, judicial cases, and the will of senior executives. Startups may also excessively publicize some information that is beneficial to themselves, and deliberately conceal or understate the information that is harmful to themselves. While venture capital may be deceived to some extent, making a wrong judgment,

[①] WWW.JFQ.COM.(2018，October 9)*The Capital behind JD which Holds a Fund of $60 Billion and Invests 300 Million Despite that Only 75 Million is Needed by Liu Qiangdong* .https://baijiahao.baidu.com/s?id=1613818126683493556&wfr=spider&for=pc

and selecting the startups that have proved to be poorly operating afterward.

There are mainly two measures for venture capital to prevent passive adverse selection caused by information asymmetry: One is to strengthen the collection of information and increase the symmetry of information, such as strengthening due diligence, especially the collection and analysis on financial information, legal information, market information, industrial chain upstream and downstream suppliers and customers, competitors, industry development, etc., to form information judgments closer to the real situations, in order to reduce information asymmetry. The second is to use the valuation adjustment mechanism to reduce the harm of information asymmetry. Assuming that the startups do not provide completely true information, including performance prediction and commitment, exaggerating the development potential, hiding important information, etc., venture capital can take some kind of punishments based on valuation adjustment mechanism to form constraints and deterrents on the invested startups to reduce the risk of adverse selection caused by information asymmetry.

5.1.2 Selection of startups

The market-oriented adverse selection of Chinese venture capital market is two-way. From the practical observation, in addition to the adverse selection of venture capital, i.e., venture capital deliberately selects the startups with poor operating performance as investment

targets, the adverse selection of startups also exists, i.e., startups with bad operating performance are more willing to accept venture capital investment.

The startups with better operating performance have more smooth financing channels and do not necessarily select venture capital after comparing the financing costs. However, startups with poorer operating performance do not have smooth financing channels. They have higher desire for funds and more welcome venture capital. This reason will also cause the negative correlation between venture capital and the performance of invested companies in reality.

It should be noted here that when the startups with poor operating performance attract venture capital, they may form an interest transfer to the management team of venture capital, which means to use the principal-agent relationship between venture capital and venture capital managers to make a profit for the venture capital managers which in turn facilitates adverse selection of venture capital. For startups with better operating performance, the possibility of benefit transfer will be lower as they have more smooth financing channels. In other words, startups with band operating performance are more likely to choose venture capital, but startups with good operating performance may not necessarily choose venture capital. This is relatively common in the Chinese market. For example, Huawei and Laoganma reject venture capital, and they tend to adopt indirect financing.

Due to the principal-agent relationship between the venture capital fund and the fund management team, on the one hand, since the fund management team invests in a startup with relatively poor operating performance, they may ask the startup to transfer certain benefits so that the management team will generate such motivation; on the other hand, the financing channels of startups with poor operating performance are more limited, and financing is more difficult. In order to obtain venture capital, startups also have the willingness to transfer benefits. In this way, the moral risks of benefit transfer sometimes exist.

For venture capital, since it tends to invest in startups with poor operating performance, it should be aware of the huge risks involved in investment activities. This study uses Chinese GEM listed companies as a sample, but there are many invested startups actually cannot go public. The investment exit channel is not smooth, and the risks are self-evident. Although the venture capital community has long recognized the law of “seven projects will lose, two will break even, and one will gain profit”. The investment of project is allowed to fail, but it should also be noted that due to the adverse selection, and the principal-agent relationship between venture capital and its managers, the failure risk and moral risk faced by venture capital are becoming increasingly serious. In the context where the current trend of China’s economic growth is difficult to reverse, if the GPs of venture capital have a hard time, then those who purely serve as LPs can only face a huge risk.

Under the condition of market economy, adverse selection caused by the principal-agent mechanism is unethical and should be avoided. Certainly, it is unethical or even illegal for startups to obtain venture capital through profit transfer. Although such phenomenon exists, it is not the main reason causing the adverse selection of venture capital.

5.2 Adverse selection effect in venture capital

The empirical analysis in Chapter 4 of this paper demonstrates the adverse selection phenomenon in the process of venture capital. The preceding content of this chapter has analyzed the possible causes of adverse selection. Next, the effects and impacts on China's venture capital market under the adverse selection will be discussed.

5.2.1 Improve the possibility for startups to obtain venture capital through adverse selection

Since venture capital more favors the startups with poor operating performance in the process of selecting invested companies and projects, startups can structurally reduce certain operating performance indicators according to their own actual conditions, thereby increasing the chance and probability of obtaining venture capital.

Structural adjustment of the profitability, solvency, and operating capabilities of the operating performance of startups will help improve the possibility of attracting venture capital. The research in Chapter 4 shows that, while keeping other explaining variables unchanged, the lower the profitability, the more conducive to attracting venture capital and improving the possibility of attracting venture capital. This can be

derived after testing the research hypothesis “There is a negative correlation between venture capital and the weighted ROE and ROA of operating performance of startups”. In terms of the solvency and operating capabilities, there is also a certain negative correlation. Although it’s not statistically significant, it also means that lower solvency and operating capabilities may help improve the possibility to obtain venture capital.

Therefore, in order to increase the possibility of obtaining venture capital, startups can intentionally make certain adjustments to business strategies, financial plans, strategic planning, etc., so as to finally obtain the venture capital.

Firstly, increase investment in research and development, technology, etc., and increase forward-looking investment sub-projects, so that the ROE and ROA will be reduced. Although the profitability will decline, the future development prospects are bright. Telling a good story can increase the probability of obtaining venture capital.

Secondly, increase the intensity of debt management to a certain extent, increase fixed assets, reduce the CR, QR, etc. to reduce the solvency, which may also increase the probability of obtaining venture capital.

Thirdly, increase inventory and total assets and do not rush to collect payments for market orders and reduce I_TURNOVER and TAT. But with the promising market prospects, it may also increase the probability of obtaining venture capital.

Certainly, startups mainly optimize the structure under stock conditions, make some minor adjustments to operation, finance, strategy, R&D, and market, and respond to the concerns and preferences of venture capital, rather than create a poor operating performance divorced from the actual situation. If that is the case, it is possible that the companies will burn their own fingers before absorbing the venture capital, which is contrary to the original good intention of the author.

5.2.2 Lemon market under the adverse selection effect

The lemon market effect refers to that in the case of adverse selection, good products are often eliminated, and inferior products will gradually occupy the market to replace good products, resulting in a market filled with inferior products. In terms of startups, since startups with poor operating performance are eager to absorb venture capital, they are willing to lower their valuations, and even do not hesitate to transfer profits to the venture capital managers. Therefore, the “lemon market” effect has been formed in the invested companies: Companies with good operating performance are treated as bad companies, so that good companies are increasingly staying far away from venture capital, and most of the companies in the market are startups with poor operating performance.

The phenomenon of the lemon market has already emerged in China’s venture capital market. The remaining market participants are mainly bad startups and bad capital. Good startups are reluctant to accept venture capital while good capital is not willing to engage in the venture

capital industry, which should be noted. This is also related to the adverse selection of the venture capital market. The essence of adverse selection is to reward poor students. Instead, the poor quality startups have been invested by venture capital, and the poor management teams in venture funds have achieved success. It is because of the possible benefit transfer and moral risks in the adverse selection. If a company is excellent, it may not easily transfer the equity at a lower valuation, and the fund manager will not accept the benefit transfer if it invests with its own funds. Despite that the information asymmetry may trigger the lemon market, the principal-agent mechanism in the venture capital market is the most important source of the lemon market of venture capital.

In theory, venture capital is an important means of optimizing the allocation of precious resources such as capital, and good companies and excellent fund management teams can get more benefits. However, due to the principal-agent mechanism, the lemon market has already emerged. A powerful way to break the lemon market is to break the principal-agent mechanism. For example, increase the investment ratio of the fund management team or the main responsible person in venture capital, so that a large proportion of venture capital belongs to the management team, and the desire of management team to accept the benefit transfer and invest in startups with poor performance will be reduced. Or change the management mechanism of venture capital. A venture capital fund can set up two independent management teams to be responsible for investing and auditing and post-investment

management respectively. Once mutually restricted, two teams may perform better in project screening and preventing benefit transfer.

Certainly, what is more important is that all participants in the Chinese venture capital market must cherish this market and don't do things that violate the law and discipline, violate the spirit of the contract, and violate professional ethics. In this way, the venture capital market will become better and better.

5.2.3 Valuation bubble under the adverse selection effect

The valuation bubble in the venture capital market is also related to adverse selection. Due to the poor operating performance, the invested startups must rely on the valuation bubble to attract new venture capital. From the perspective of startups, higher valuations will easily attract new capitals to provide new capitals and resources for companies with poor operating performance. For venture capital that has already been invested, high valuation can put the investors who do not participate in the management of venture funds more at ease. The achievements seem good, and it may even be possible to transfer the shares with the help of high valuation. Therefore, both the invested companies and venture capital have the incentive to brag about the "valuation bubble". And it is often stipulated in the investment agreement that the company valuation should not be lower than the previous round when new investors enter.

Due to the poor operating performance of the invested startups, they have great difficulties in listing, and can only conduct venture capital

financing round after round. The valuation bubble is getting bigger and bigger, and the risks are getting higher and higher. It doesn't matter that a good project has high valuation, what matters is the valuation bubble of bad projects. This has become a consensus in the field of venture capital. The main way to prevent valuation bubble is to adhere to the investment principles and adhere to value investment. Never blindly follow the trend of investment due to the beautiful appearance and the gathering of venture capitals.

Venture capital generally requires that the capital entered in the next round is not lower than the valuation of the previous round, which is an important cause for the "valuation bubble" of startups. After rounds of venture capital financing, the valuation of startups is rising while the date of listing is far from expected, which is an abnormal phenomenon. The valuation bubble exacerbates the risk of the project. Once the bubble bursts, the venture capital will be wiped out and the startups will fall through in a flash, which goes against for the sustainable development of venture capital and startups

It has been observed that venture capital prefers startups with lower valuations in Section 4.4 of this thesis, which does not conflict with valuation bubbles caused by adverse selection. Because the IPO cross-section is adopted at this observation timing, the valuation of startups may show a changing curve, representing in different forms such as low→lower→high→lower, which is difficult to observe in IPO cross-sectional data. For example, on October 30, 2020, the IPO of LU.com, China's financial technology "unicorn", succeeded on the New

York Stock Exchange, but the stock price fell below the IPO price on that day. Its opening price was $11.6, which was 14.1% lower than the previous issuing price of $13.5. As of the close, it fell 4.81% and closed at US$12.85, corresponding to a market value of US$31.35 billion. Compared with the valuation of US$39.4 billion in Series C financing in 2019, the valuation was 20% off. It can be considered that there was a certain valuation bubble in Series C financing[①].

In recent years, the most obvious valuation bubble of the venture capital market appears in the field of artificial intelligence (AI)[②]. From 2016 to 2017, China's VC/PE market was well funded, and there were not many investment trends. A large amount of capital flowed into the AI industry. At that time, the investment in AI was almost crazy. Financing seemed to become a competition for the top AI companies, and the financing record of the industry was refreshed again and again. For example, SenseTime, established in 2014, has seen its valuation soar to 2 billion dollars in just three years. In July 2017, SenseTime announced that it had completed the 410 million dollars in Series B financing, setting a global record for a single round of financing in the field of artificial intelligence at the time. In April 2018, SenseTime

① Yu Yao. (2020,November 1). *The Former P2P Giant Ran in front of Ant Group, But Fell below the IPO Price after "20% off" Listing*.https://new.qq.com/rain/a/20201101A0AKDT00

② China Renaissance. (2020, January 21). *We See the Next Red Sea in the AI industry*.https://mp.weixin.qq.com/s?__biz=MzAwMDE3MjUyMQ==&mid=2650603726&idx=1&sn=c7e1bc4c94357568319b94b262de41e3&chksm=82e4a848b593215ea11a3a3970da43ffc99c1efe3f6f48407a27215fc5506844615a957351ef&mpshare=1&scene=1&srcid=0227fvbLAB44Rk03ONNMNk6N&sharer_sharetime=1582776543111&sharer_shareid=a4187d699a3c1cf01bb19a2172fb95b2&key=2a1e36d68a48cb576167497aa501bda40e65781d7fea409e9363a766cc74af41756d6524977d7f849edc9da33e6292c7081c8aeaccf477bd27544a3cbc9d2fd9e0bb73b56797cdbe360ebeced0f6842f&ascene=1&uin=MTkwODM3MTEwNg%3D%3D&devicetype=Windows+7&version=62090070&lang=zh_CN&exportkey=A3ZXPh9FTsI5CwdCn3xpCpk%3D&pass_ticket=gAGYzMEi%2FytN4Gqf%2Fg8lExrufTs3uTGA19%2F%2F16VCWfeOMPnctIYC4ra9HJUuQaNO

completed the 600 million dollars in Series C financing led by Alibaba Group, again setting a global financing record in the field of artificial intelligence; a month later, it received another 620 million dollars in Series C+ financing; more than three months later, it once again received 1 billion dollars of financing from Softbank, and its valuation soared to 6 billion dollars. From April to September 2018, SenseTime obtained three rounds of financing in succession in 5 months, and the amount of these three rounds of financing alone exceeded 2.2 billion dollars. Looking at the history of global venture capital, it is hard to find another startup that can intensively obtain such a large amount of financing. While CloudWalk and YITU, which were treated as the “Four Tigers” in the field of computer vision together with SenseTime, also continuously conducted financing during this period. In June 2018, CloudWalk announced that it had received 1 billion yuan in Series B+ financing; Yitu also announced that it had won 300 million US dollars two successive rounds of financing in June and July. This was really rare in the history of China’s venture capital. The multibillion dollars of capital were invested wave after wave. For these AI unicorns, the year of 2018 was a fantastic year.

But it was also in 2018 that the difficulty of raising funds in the primary market broke out in an all-round way, and the cold winter of capital began to spread to the AI industry. The direct manifestation was that the financing of some AI companies got difficult, and the survival problems of a large number of AI startups gradually emerged. Starting in 2019, the sequelae appeared. Huge amount of financing was a

double-edged sword, which directly pushed the valuation of AI companies to a level prohibitive to most VC/PE. The Chinese investment in AI field and the number of investments fell sharply. In 2020, investors began to re-examine the liquidity and expansion space of AI companies. After estimation of input and output, the capital fever gradually subsided. Without the capital, AI companies trapped in capital pressure either quietly closed down, or they began to seek the road to listing. Megvii submitted a prospectus to the Hong Kong Stock Exchange in August 2019, but this IPO was not smooth. Six months after submitting the listing application, the status of IPO process of Megvii on the Hong Kong Stock Exchange was shown as “invalid”. SenseTime, another AI star company, was recently reported by foreign media to postpone its first IPO plan of 750 million dollars in Hong Kong this year, and turn to the private equity market to seek 500 million to 1 billion dollars of financing. According to industry sources, the listing of these two AI unicorns in Hong Kong has been frustrated because their valuation may have not been recognized. It is foreseeable that 2020 will be a watershed for Chinese AI companies - some players will suffer a dismal failure, while others will join in the secondary market to accept a greater test. Bankruptcy may have just begun in the group of AI companies.[①]

[①] JRJ.com.(2020,May 6).The AI Companies Begin to Go Bankrupt.https://mparticle.uc.cn/article_org.html?uc_biz_str=S%3Acustom%7CC%3Aiflow_wm2&btifl=100&uc_param_str=frdnsnpfvecpntnwprdssskt&client=ucweb&wm_id=789d831010a242888196e223f9c25e09&title_type=1&pagetype=share&app=undefined&wm_cid=353818425224596480&uc_share_depth=1&source=share-back

The valuation bubble in the AI field is a vivid manifestation of venture capital in pursing high risk and high yield and a true portrayal of the market-based adverse selection effect. However, when the valuation bubble bursts, no matter whether it is an AI company or venture capital, “every snowflake in an avalanche ever should be responsible.”

5.2.4 Moral risk under the adverse selection effect

Due to the principal-agent relationship between the venture capital fund and the fund management team, under the adverse selection effect, on the one hand, since the fund management team invests in a startup with relatively poor operating performance, they may ask the startup to transfer certain benefits so that the management team will generate such motivation; on the other hand, the financing channels of startups with poor operating performance are more limited, and financing is more difficult. In order to obtain venture capital, startups also have the willingness to transfer benefits. In this way, the moral risks of benefit transfer sometimes exist.

At present, the measures of the venture capital market to prevent moral risk are mainly the restrictions of systems. Since the early days of the venture fund, the investment targets and management teams should reach agreements, such as the types of fields, industries and companies that cannot be invested, as well as the dos and don’ts of general managers of management teas and the due diligence personnel, the authorities of investment decision committees and the veto power agreed by the sponsors of some major project funds. These

system constraints are mainly used to prevent moral risks and prevent the management team from accepting benefits. At the same time, the author also believes that the moral risk cannot be completely eliminated by relying solely on system constraints. In-depth investigations should be conducted on the initial selection of management team, including the professional competence, professional ethics, and professionalism of the management team. After pre-screening, the participation of those who fail to meet the requirements of fund sponsors should be rejected, after all, people matter most in the investment field.

5.2.5 About the threshold problem of the operating performance of startups and the entry of venture capital

The paper mainly discusses the relationship between venture capital and the operating performance of startups. It is worth noting that the samples of empirical analysis are all GEM listed companies. The ability to list on Chinese stocks is enough to prove that these companies are relatively high-quality. It just reveals that among the group of listed companies, the operating performance of these listed companies with risk investment is generally worse, and even the worse the operating performance, the more likely they are to attract venture capital.

More broadly, although the startups with poorer operating performance have a greater probability of attracting venture capital, it does not indicate that startups with nearly zero operating performance have an infinite probability of obtaining venture capital. There must be a lower limit for the scale, technology content, and development prospects of

the startups. Below this lower limit-the threshold, the startups will basically receive no attention from venture capital. For example, if a dormant company has no business activities and no possibility of backing from the brink, and its operating performance is 0, it will definitely not be favored by venture capital.

Therefore, there should be a threshold for poor operating performance of startups. Below this threshold, the negative correlation between the probability of the entry of venture capital and the operating performance of startups no longer exists. Due to the paper selects GEM listed companies with good quality as samples, this threshold has not been further discussed. But according to the common sense of investment, such threshold does exist and is a basic threshold in the field of venture capital that cannot be ignored.

From another perspective, although there are certain moral risks, valuation bubble, lemon market and other phenomena in the Chinese venture capital market, a bottom line threshold still exists. Below this threshold, no venture capital activities will be carried out. The field of venture capital generally has a bright appearance and high-end content. Although the situation is complex and changeable and the way is arduous and long, the Chinese venture capital market should be cautiously optimistic, and practitioners should not be frustrated.

Cognition of the threshold of operating performance of startups and entry of venture capital has certain guiding significance for investment practice activities. In practice, some companies that are far below this

threshold are also seeking venture capital. But in fact, it can be regarded that there will never be any venture capital interested in them. As a venture capital practitioner, the author has been closer to such phenomenon a lot. It is mentioned here to remind those startups that do not have the basic conditions to avoid seeking venture capital, lest a lot of labor costs, time costs and other costs are wasted without any valuable returns.

5.2.6 Relationship between adverse selection effect and other hypotheses

In Chapter 2 Fundamental Theories and Literature Review, the relevant theories of venture capital including grandstanding hypothesis, supervision hypothesis, certification hypothesis, market power hypothesis, supervisory mechanism effect, and incentive mechanism effect have been elaborated. The empirical analysis is conducted to the pre-IPO data of Chinese GEM listed companies, mainly demonstrating the adverse selection hypothesis. But it is difficult to form a verification for other hypotheses, and overall, no more supports or denials are formed for these theories.

Because there is a negative correlation between venture capital and operating performance of startups and mainly due to the theory of adverse selection, the operating performance of startups with venture capital is generally lower than that of startups without venture capital. Therefore, the adverse selection effect is not very supportive of the certification hypothesis, market power hypothesis, supervisory

mechanism effect, incentive mechanism effect and other theories holding that venture capital brings positive effects. The grandstanding hypothesis and the supervision hypothesis believe that venture capital has more negative impact on startups. But the adverse selection effect believes that the operating performance of startups is low mainly because it's generally low for its kind. The specific effects after the entry of venture capital have not been explained, which makes it difficult to verify the grandstanding hypothesis and supervision hypothesis.

In general, the entry of venture capital into startups is very complicated. Practice is far more varied than theory. The empirical analysis in this chapter shows that there mainly is a negative correlation between venture capital and the operating performance of startups, which verifies the adverse selection theory, but fails to get other theories involved. To put it another way, most of the theories proposed previously are called "hypotheses", which also shows that they are difficult to be fully verified by facts and data in practice. And these theories both have supporters and opponents, which presents how complicated the connection between venture capital and the operating performance of startups is.

Chapter 6 Countermeasure Analysis of the Impact of Venture capital on the Operating Performance of Startups

Mainly due to the adverse selection effect, it can be considered that there is a certain negative correlation between China's venture capital and the operating performance of startups. Therefore, all of venture capital, startups and third-party participants in the capital market must face up to this phenomenon, strengthen strategic response, and promote the healthy and sustainable development of China's venture capital market and capital market. Based on the results of previous empirical analysis and qualitative analysis, this chapter analyzes the relevant countermeasures of the impact of venture capital on the operating performance of startups.

6.1 Countermeasures for venture capital

There is mainly a negative correlation between venture capital and the operating performance of startups, which is caused by the adverse selection effect. If reverse investment is only caused by investment preference, risk appetite, etc., it is the result of freedom of choice in the market, and it cannot be simply judged as good or bad, but attention must be paid to avoiding the risks contained in low operating performance. If reverse investment is due to principal-agent mechanism, information asymmetry, etc., such adverse selection should be avoided in that it mainly shows the lack of professional ethics

and professional skills of the venture capital management team, which is an unethical and unhealthy adverse selection with huge risks.

6.1.1 Correctly understand the adverse selection market behaviors and avoid the risks of low operating performance

Different venture capitals have different risk appetites, corresponding to the initial, early, middle and pre-IPO stages of startups in terms of different stages focused by venture capital. Usually, the earlier the investment focus of venture capital is put, the worse the operating performance of startups for reserve investment, the greater the risk faced by venture capital and the higher the required return on investment. Due to different investment fields, different risk appetites and different investment stages, there are various types of venture capitals in the market. This is a normal phenomenon caused by different market positioning, which is of great significance to form a multi-level and diversified venture capital market and deserves encouragement.

Therefore, based on different market positioning, venture capital intentionally selects some startups with low operating performance, which is a complete market behavior. Such adverse selection is acceptable, but we must still be aware of and avoid the risks. Venture capital should understand that: The earlier the startup, the worse the operating performance, the lower the valuation and the greater the risk of unsuccessful investment. Certainly, the risk is accompanied by the profit. If successful, the excess investment return obtained is also

greater. With this correct understanding, venture capital should combine its own characteristics to calmly respond to the risks resulted from the adverse selection of market-based behaviors caused by focusing on different development stages:

The first is to pay more attention to the match-ability of fund terms. There are many reasons accounting for the low operating performance of startups, which may be staying at a lower stage of the life cycle, due to the industry, or due to the knowledge and technology contents, market competitiveness, etc. of the companies. If the industry is weak and the company is not competent, the project investment is very likely to fail and venture capital should strive to avoid it. If the company is at a lower stage of the life cycle, the venture capital may extent the time to hold the project until the company grows up before exiting. However, there is also a problem that some funds do not have a long duration. Some funds only have a life span of about 5 years. In case of projects that require long-term cultivation with a growth period of more than 10 years, they have to earn profits and exit before listing of the companies. There is a risk of mismatch of fund terms, which needs attention and solution. For example, some reserve investment projects for R&D of drugs and medical devices have a long clinical trial cycle, so they shouldn’t be participated by those funds with insufficient duration.

From another perspective, in order to avoid the risk of insufficient investment duration, venture capital managers should strive to make the duration longer and more flexible upon establishment, such as “7+3 years” or “10+2 years. The exit of project should not be influenced by

the duration as far as possible, for fear of affecting the investment returns. From the perspective of development history of venture capital, the investment returns of funds with long duration will be better. By observing successful venture capital examples, such as Softbank and KKR., it can be found that they have basically maintained a long-term duration, which is worth learning by Chinese venture capital.

The second is to pay more attention to the diversified investment. Since the risks and returns contained in low operating performance are equal, in order to reduce risks, diversified investment should be performed instead of not investing in early-stage companies with low operating performance. That is, don't put the eggs in the same basket. After reaching a large quantity of investment projects, the probability of success will be closer to the expected probability, thereby reducing investment risk. For example, the probability of successful investment in an IPO project is 10%, and the return rate after a successful project investment is 20 times. Despite that the investment return expectation is 2, for investing only one project and investing 100 projects, the latter's risk of finally achieving 2 times of returns is much smaller than the former.

The third is to pay more attention to the match-ability of fund size. In order to avoid investment risks, it is necessary to expand the quantity of investment projects to strengthen diversified investment. Although the operating performance of startups is low and the corresponding valuation is low, the number of projects for the fund to invest can be relatively higher. However, venture capital still needs to pay attention to

the match-ability of adverse selection and fund size. If the fund size is small, it is best to invest in relatively mature startups with better operating performance. The IPOs of such startups have a higher probability of success, and certainly the return on investment will be smaller. The project quantity of diversified investment can be small, which is conducive to ensure that the expected return on investment is achieved. Venture capital with a large fund size is more suitable for investing in early-stage projects. The project quantity can be larger and the investment period can be longer. Although the risk of failure of a single project is higher, the return rate will be higher once the investment is successful. Thus, the quantity of investment projects will ensure that the expected returns of the fund are achieved. Therefore, under the adverse selection effect, the fund positioning and the fund size must be matched.

6.1.2 Strengthen the building of the professional capabilities and avoid the risks of information asymmetry

The information asymmetry between venture capital and startups is one of the important reasons for adverse selection, which may cause the generally low operating performance of startups with venture capital. Besides, this reverse selection is passively accepted by venture capital and should be overcome. As the saying goes, “the buyer is not as astute as the seller”. As a party that sells shares, startups have a natural information advantage in the activities of attracting venture capital. But the risk fund management team can also minimize the risk of information asymmetry through professional capability building.

The first is to strengthen the training of the professional capabilities of the fund management team. Improve the analysis and judgment capabilities of due diligence personnel in industry development, market competition, financial audit, legal disputes, business models and so on, strengthen the screening and review of all information provided by startup companies for reservation investment, do more thinking and ask more questions. For the documents, forms and materials that are generally required for the due diligence of venture capital, ask the invested startups to try their best to provide. If not provided, the reason must be explained, and the inquiry must be strengthened in case of any doubts. At the same time, archive the due diligence documents and backup files, write a clear and brief due diligence report to make the detailed, accurate and authentic decision-making information available to people pontificating the investment decision-making of project, in order to minimize the information asymmetry risk between the venture capital and startups.

Generally speaking, the information fraud in the venture capital process is mainly caused by the incomprehension of risk fund management team for the industry, market, upstream and downstream of the industry chain, etc., so a single venture capital fund often only pays attention to a few related industries. Having a thorough grasp of these related industries and forming a profound understanding of industry development, business models, industry leading companies, and upstream and downstream of the industry chain can generally reduce information asymmetry. It is not easy to achieve this state and takes a

long time for accumulation. The development of professional capabilities depends on the introduction of industry talents and long-term precipitation. Many high-end talents in the industry switch to venture capital. Since they are industry experts, they have a deeper understanding and grasp of the industry and perform better at investing. This is what the venture capital management team needs to pay attention to.

The second is to use legal constraints, such as valuation adjustment mechanisms, miscellaneous provisions, and performance commitments, to reduce the risks of information asymmetry. For the possible situations where reserve investment startups exaggerate performance, are overconfident and have wrong judgments, the venture capital management team should utilize the professional capabilities and combine with actual conditions to design legal constraints, such as valuation adjustment mechanisms, miscellaneous provisions, in order to prevent the situation that may be unfavorable to the capital side caused by information asymmetry. In reality, it is difficult to exhaust all information and check the authenticity of various information. Not only the cost is very high, but it even arouses the antipathy of startups for reservation investment. At this time, the investment management team can assume that the other party is trustworthy and the relevant information provided is true. But if it is confirmed that there are acts of dishonesty, untruthfulness and deliberate exaggeration afterwards, the other party is required to bear corresponding responsibilities in accordance with the legal constrains

and provide some forms of compensation for the loss caused. In this way, the costs for verifying the information can be reduced and the risk of information asymmetry can be avoided to a large extent.

The third is to introduce necessary temporary external experts to strengthen the professional capabilities of the team. It is difficult for the venture capital fund management team to be highly professional in the industries and projects involved. In order to consolidate the professional capabilities of the management team, external experts can be duly introduced during the voting meeting of investment decision committee, external consultation, industry analysis, etc. For example, experts, professors and executives in scientific research institutes, industry associations and leading companies can be consulted for their opinions and solving the problems of reserve investment projects, in order to strengthen the recognition on the reserve investment companies and projects, eliminate information asymmetry and avoid relevant risks.

6.1.3 Strengthen the institutional constraints of the principal-agent mechanism to prevent moral risks

Upon the establishment of the venture capital fund, there is seldom investment based solely on the management team's own funds. Generally, funding is raised externally, forming the link of the persons who contribute the capital for investment - limited partner (LP) and the person who contributes a small amount of capital and manages the fund - the general partner (GP). The LP and GP constitute the

principal-agent mechanism. LP is the principal, and the capitals are entrusted to the venture capital fund manager for investment and management. GP participates in the venture fund contribution with a small amount of capital, acting as a manager of venture capital fund to invest externally and conduct post-investment management, investment exit and other business activities on behalf of venture capital fund.

Due to the principal-agent relationship, the interests between LP and GP are not always consistent. LP seeks to maximize the interests of venture capital funds, and GP seeks to maximize its own interests - mainly including the annual management fees and excessive profit sharing after exit, etc., But it does not rule out accepting the benefits from invested startups during the investment management process. At this time, adverse selection is easy to occur - that is, tending to invest in startups with poor operating performance that transfer benefits to GP, which in turn triggers moral risks.

In terms of invested startups, companies with poor operating performance are harder in financing and have more limited channels due to lower profitability and CR, so they are more eager to attract venture capital, and even transfer some benefits to the venture capital fund management team. Under the influence of both the venture capital fund management team and the invested startups, the adverse selection and moral risks are difficult to avoid completely.

The moral risks in venture capital activities is unethical, which may cause losses to venture capital, or partially reduce the return of venture capital, mainly damaging the interests of LP. Once things are brought to light, the entire venture capital fund will suffer the credit loss. The moral risks must be strictly prevented and eliminated.

In order to prevent moral risks, regulations are often specified in the prospectus (which may also directly be the fund charter) of the venture capital fund to explain and stipulate the investment field, industry distribution and project standards after the fund is established, agree in advance on the responsibilities scope, code of conduct and fund management of fund managers, and introduce the office resume, investment performance and academic background of the team, which is like an endorsement of professional ethics and professional skills. It can be considered that the prospectus is the constitution of a venture capital fund, to formulate strict system regulations on the investment management team. In case of violations, LPs can hold the investment management team accountable in accordance with the prospectus and the fund charter, fund agreement, and relevant violation clauses formed in accordance with the prospectus.

Since the prospectus, fund charter and agreement related to fund establishment of the venture capital fund are generally prepared by the investment management team, which is relatively beneficial to the GP, but for the investor LP, this is not fair as these documents are a bit similar to the format contract. From the perspective of protecting itself,

LP should boldly propose its own amendments to the relevant clauses to form more powerful binding regulations.

Therefore, the professional ethics and self-cultivation of management team have to be mentioned. Institutional constraints are fundamental for preventing moral risks. A good system encourages people to have motivation for being moral and doing good, but the professional ethics and self-cultivation of management tea are the foundation. Without this foundation, the best system will be manipulated and broken. As the institutions cannot predict all the situations in advance and make corresponding arrangements, more often, the moral risks are reduced relying on the management team's consciousness. In the meanwhile, the occurrence of moral risks is minimized due to the deterrence of the relevant institutional constraints, the influence of the career reputation, and the pursuit of career achievements.

In brief, strengthening the institutional constraints on the principal-agent relationship during fundraising, investment, management and exit of venture capital funds will be beneficial to prevent the occurrence of moral risk events.

6.2 Countermeasures for startups

The poor operating performance is more conducive to absorbing venture capital, so some countermeasures can be made accordingly by startups.

6.2.1 Structurally improve the operating performance indicators and increase the probability of obtaining venture capital

The empirical analysis in Chapter 4 shows that there is a negative correlation between the profitability, solvency, operating capabilities of the operating performance of startups and venture capital. By structurally improving certain performance indicators, the probability of obtaining venture capital can be improved.

The first is to reduce the profitability indicator of operating performance. The profitability indicator is mainly positively correlated to profit and negatively correlated to assets. Both reducing profits and increasing assets can reduce profitability, which will help attract venture capital and increase the entry probability of venture capital. Generally, it is mainly considered to increase investment with profits to form new assets. For example, make significant investment in the future development, increase investment in R&D and technology, and increase investment in forward-looking sub-projects, which will reduce the ROE and profitability of companies and increase the probability of obtaining venture capital.

The second is to reduce the solvency indicator to a certain extent. Solvency is positively correlated to current assets and negatively correlated to liabilities. Solvency indicator can be reduced by increasing the intensity of leverage, increasing fixed assets, and reducing the current assets of company. In practice, the appropriate liability ratio can make the operating efficiency reach the best state. For a startup, the opportunity to increase leverage can make the company develop faster and possibly increase the probability of obtaining venture capital. Certainly, it is difficult for a startup to increase its leverage, mainly due

to the lack of collateral and pledged assets required by bank loans. But at least if there is an opportunity, it should not be missed.

The third is to reduce the operating capabilities indicator to a certain extent. Operating capabilities are mainly positively correlated to cash inflows and negatively correlated to assets. By reducing cash inflows and increasing assets, the operating capabilities indicator can be reduced. For example, increasing inventory and not rushing to collect payments for market orders will reduce the operating capabilities indicator, and may increase the probability of obtaining venture capital.

It should be emphasized that the above indicator adjustment is structural, and the profitability indicator is the most sensitive and should be prioritized. Instead of intentionally obstructing the development of startups, according to the preference of venture capital, startups make adjustments to technology improvement, market development, and long-term planning and development. After these adjustments, the recent operating performance indicators are reduced, which, however, is very helpful for future growth. In this way, startups may attract more venture capital. This paper is not intended to provide countermeasures that are unethical and inconsistent with market rules, but only to point out that through structural optimization, startups can better meet the requirements and preferences of venture capital.

6.2.2 Jointly build a good reserve investment party and prevent the lemon market

The startups generally constitute all the reserve investment targets of venture capital. In order to gain the favor of venture capital, they display their respective abilities and fight their own battles. However, on the other hand, they unite to form an overall reserve investment market of venture capital. Therefore, they are also obliged to maintain a good order and reputation in this market. Because once this market becomes a lemon market, both investors and reserve investment party are inferior entities. When good companies and capital are not willing to participate in venture capital activities, a single startup will also suffer losses of being difficult to finance with venture capital.

Firstly, startups should set high standards for themselves. This includes no fraud, no benefit transfer, and maintaining a healthy cooperative relationship with venture capital, etc., in order to facilitate the constituents of the reserve investment party market of venture capital to maintain a high moral level.

Secondly, for the sake of safeguarding the industry's interests and the clean and maintain a pure market of the reserve investment party, they should speak out on and together resist the unethical behaviors in the reserve investment market. For example, if a venture capital consults the technical level or market prospect of certain startup, the truth should be told instead of doing things contrary to the will out of some needs. A well-known example is Dong Mingzhu's investment in Zhuhai Yinlong. The lithium titanate battery technology of Zhuhai Yinlong was actually a technology that had been obsolete in the United States. However, it is still unknown whether any industry players or enterprises warned Mrs.

Dong some. The overall failure of this project investment has damaged the enthusiasm of venture capital in the field of lithium batteries and new energy vehicles, causing a far-reaching negative impact. But it could actually be avoided if any warning can be given[①].

6.2.3 Correctly regard the threshold of venture capital and avoid the excessive pursuit of venture capital

The empirical analysis in this paper does not involve the threshold of venture capital, but as described above, it does not indicate that startups with nearly zero operating performance have an infinite probability of obtaining venture capital. There must be a lower limit for the scale, technology content, and development prospects of the startups. Below this lower limit, the startups will basically receive no attention from venture capital. Therefore, startups should also avoid excessive pursuit of venture capital, resulting in waste of manpower, material resources, financial resources and time.

Venture capital has its own focuses, requirements and thresholds. Before introducing venture capital, startups should conduct an objective comprehensive assessment. If they believe that they are still far from the threshold of venture capital, they do not need to start the matters related to the introduction of venture capital, which benefits both startups and venture capital in terms of reducing cost waste and improving business efficiency.

[①] Sohu Finance.(2018,August 10).*Yinlong IPO was Terminated! Is Dong Mingzhu's "Car-making Dream" Going to Be Shattered?*. https://www.sohu.com/a/246126096_100224431

Generally speaking, traditional small and micro enterprises, low knowledge and technology content, insufficient growth, outdated business models, the small scale and low quality level of startup teams are all taboos for venture capital. If three or more conditions are met, it is basically unnecessary to consider attracting venture capital, so as to avoid wasting communication costs. The threshold of venture capital is proposed mainly based on the perspective of improving the efficiency of the whole society and for reference of all parties.

6.3 Countermeasures for other capital market participants

The venture capital market is closely linked to the capital market, and the IPO is always the most important channel for the exit of venture capital. In recent years, the influence of venture capital on the capital market has been increasing. Based on the impact between venture capital and the operating performance of startups, some countermeasure suggestions for other capital market participants are put forward.

6.3.1 Countermeasure suggestions for the regulatory authorities

Venture capital plays an important role in the switching of new economy and new growth drivers of China, innovation and startup, and high-tech development, while the startups are the main carriers of these economic activities. Therefore, regulatory authorities, including the China Securities Regulatory Commission, stock exchanges and units related to market supervision, should not only encourage the continuous and rapid development of venture capital and startups, but

also should notice the adverse selection between venture capital and the operating performance of startups, strengthen the supervision, and regulate the behavior of venture capital and startups.

(1) Promote the development of venture capital and encourage startups to engage in direct financing

In order to promote the development of venture capital, the main measures adopted by relevant government departments in China include the establishment of guidance funds to participate in venture capital raising and the establishment of state-owned venture capital funds for direct investment.

In order to encourage and guide the development of venture capital, Chinese governments at all levels have set up guidance funds to participate in capital contribution as investors upon the establishment of venture capital funds, and encourage various types of capital to enter the field of venture capital through the methods of shareholding, subsidies, incentives, profit tax preference, etc. With reference to international experience, the intensity of input in guidance funds can be increased in the future.

For a long time, the relevant departments of the Chinese government have been an important pillar of economic development, industrial support and enterprise subsidies. In order to promote the development of venture capital, in recent years, the relevant departments have coordinated the use of funds through cooperation to further promote the “transfer from allocation to investment” of financial funds, established

state-owned venture capital funds, and given play to the leverage and demonstration effects of financial funds to lead the state-owned and social capital into the field of venture capital. At present, China's venture capital market has formed a trend of co-existence of international venture capital, state-owned venture capital and private venture capital. The growth of state-owned venture capital is conducive to increasing the total supply of venture capital, and the intensity of input can be increased in the future.

In order to encourage direct financing for startups, the Chinese government has launched a series of related policies, including subsidies and incentives, combination of investment and loan, and green channels for IPOs in western enterprises, to support startups in obtaining venture capital as well as the listing and financing in the capital market, alleviate the difficulty and reduce the cost of financing for startups. Certain results have been achieved at present, and support can be further increased in the future.

(2) Promote the innovative development of startups and create favorable conditions for IPOs

In order to promote the innovation and development of startups, the Chinese government has issued multiple measures such as identifying high-tech enterprises, encouraging investment in emerging industries, and supporting the development of SMEs, and focused on supporting innovation and startups activities in seven major areas including energy conservation and environmental protection, emerging information

industry, biological industry, new energy, new energy vehicles, high-end equipment manufacturing and new materials, which have also caused controversy over excessive subsidies and market distortions. In the future, in accordance with the requirements of the market economy, the support for startups will be enhanced to promote the transformation and upgrading of traditional industries and encourage the development of emerging industries, which will help booster the realization of the switching of new and old growth drivers and innovative development of national economy.

In the context of the development of the new economy and new growth drivers and the booming of high-tech industries, venture capital will be bound to accomplish great deeds. With the continuous emergence of investment targets, the scale of venture capital continues to expand. Regulatory authorities can guide the situation in the light of its general trend and create conditions for venture capital and startups to realize IPO, mainly including:

Firstly, accelerate the IPO review and completely solve the problem of “stagnancy” for pending companies for IPO.

Secondly, accelerate the reform of the registration system and lower the IPO threshold. The high IPO threshold does not meet the requirements of marketization, and is easy to cause the artificially high value of new shares, which harms the secondary market investors, makes the stock market sluggish for a long time, and damages the investment and financing functions of the stock market. Therefore,

lowering the IPO threshold is beneficial to restoring the original function of stock market.

Thirdly, accelerate the integration of the capital market and international standards, and encourage startups to conduct overseas IPOs. At present, the premiums for listing of startups are excessive in China's stock market, which not only damages the secondary investors in the market, but also causes many startups to bunch up in the domestic capital market and lack the motivation to seek IPOs in overseas markets. Only by accelerating the integration with international standards, restoring the basic functions and original status of the capital market, enabling good companies to receive high premiums, and bad companies to receive low premiums or even be punished, can a healthy capital market system be formed, which is also beneficial to boosting the overseas expansion and sustainable and healthy development of venture capital and startups.

(3) Improve the regulatory measures for venture capital and improve the exit channels for venture capital

Necessary supervision needs to be strengthened on venture capital. The current supervisory measures mainly include product filing, penetrative supervision of capital sources, and new regulations on asset management products, specifically: Firstly, venture capital must be filed with the Asset Management Association of China to report the registration information, fund size, fund charter, fund shareholders, duration, management team, annual audit report, etc.; secondly,

change the old way of supervising the shareholders of investors only, conduct penetrative supervision on investors to trace the source to the end to prevent non-compliant investment; thirdly, with the new regulations on asset management, prohibit product nesting and the promise of fixed income to investors, reveal the normal risks of venture capital and prevent risk events.

Generally, the current regulatory measures have both advantages and disadvantages. The advantages lie in regulating some behaviors of venture capital, while the disadvantages include that there are non-market-based behaviors. For example, the filing system is contrary to market principles. In theory, capital investment is completely market-based and doesn't need reporting, just like buying and selling commodities in a mall. The cause of the filing system is that some criminals carry out illegal fund-raising activities in the name of venture capital. In order to prevent illegal activities and supervise legal activities, it seems to be suspected as over-regulation or improper supervision, and may not necessarily play a role in the fight against illegal fund-raising. A certain balance between regulation and the free market is thus required, which exactly is the direction of improving the regulatory measures for venture capital. At present, the requirements for filing should be reduced at least. The current filing system makes some enterprises and groups that really want to engage in venture capital face hard times and violate the laws of market development.

In terms of improving the exit channel for venture capital, the most ideal exit way for venture capital is IPO, but IPO has great difficulties and

high threshold. The introduction of the Science and Technology Innovation Board has relatively lowered some thresholds. In the future, the threshold should be further lowered, and support should be increased for exit channels such as equity transfers, mergers and acquisitions and reorganization to smooth the exit channel for venture capital.

6.3.2 Countermeasure suggestions for the agencies

Agencies in the capital market consist of securities firms, securities sponsors, accounting firms, and law firms. Their main role is to help regulate the development of non-listed companies, and promote qualified startups to conduct IPOs and issue bonds.

(1) Pay close attention to the adverse selection of venture capital and promote the compliance development of startups

Compared with startups, venture capital is more closely connected with agencies such as securities firms, securities sponsors, accounting firms and law firms. With the help of agencies, vigorously promoting the rapid IPO of invested startups is also one of value-added services often provided by venture capital.

In the process of carrying out listing counseling and compliance review for startups with venture capital, agencies tend to be influenced by venture capital, ignore the adverse selection of venture capital, and make mistakes such as dressing up the performance and falsification to speed up the IPOs of startups and help venture capital exit quickly and

smoothly. This practice has caused severe damage to the capital market and should be vigorously held down.

As China implements the guidance system and sponsorship system in capital market, it requires non-listed startups to engage securities firms for guidance, and can only apply for listing after the guidance period expires. During the listing application process, the guidance securities firm automatically becomes a sponsor broker, and the startup will be recommended by the sponsor (individual qualified for recommendation) of sponsor broker. After the listing of startup is approved, the sponsor broker must become an underwriter or one of joint underwriters and continue to act as a sponsor broker after the IPO, in order to ensure that the listed company continues to receive professional compliance guidance and achieve long-term healthy development. This system is designed to be in line with international standards, and has achieved good results in practice, but there are also problems that counseling and sponsorship become a mere formality.

Therefore, in the process of listing guidance and sponsorship for startups with venture capital, agencies including securities firms, accounting firms and law firms must set the correct goal, that is, to help startups meet the requirements of listing, and rectify the problems to achieve the compliance development and growth of startups, rather than using the professional capabilities of the agencies to cover up the problems and spoil things by excessive enthusiasm, and push the unqualified startups to the capital market. It may not be beneficial to the startups, but also irresponsible for the majority of capital market

investors. In recent years, there have been a lot of punishments on the guidance and sponsoring brokers by regulatory authorities, indicating that there's still a lot of room for agencies to make improvements in promoting the compliance development of startups.

(2) Shape the friendly multi-party cooperation and promote the rapid growth of startups

Venture capital, startups and agencies should set a common goal, that is, to make startups stronger and bigger. In this way, venture capital will obtain investment returns, startups will obtain development returns, and agencies will obtain commission. If these returns are not gained from the growth of startups, then the returns obtained by all parties contain unethical elements.

In order to achieve this goal, venture capital, startups and agencies must work together to form a friendly relationship through multi-party cooperation. By respectively exerting their professional capabilities, resource integration and sharing can be achieved to form a "1+1+1>3" effect in order to promote the rapid growth of startups. Finally, all parties will obtain their own returns, and also add high-quality assets, wealth and welfare to society.

6.3.3 Countermeasure suggestions for investors in primary and secondary markets

Due to the adverse selection effect, there is a certain negative correlation between venture capital and the operating performance of startups. In this way, startups still have an impact on the capital market

after IPO, and investors in the primary and secondary markets of the capital market should also respond appropriately.

(1) Correctly regard the possible valuation bubble of venture capital

Startups with venture capital generally have lower operating performance. This does not mean that these companies cannot go public, but that they cannot be given an excessive premium. Only when the price and value are basically consistent is the normal investment target.

In China's capital market, due to the certain halo effect of venture capital and due to the adverse selection of venture capital, the startups with low operating performance are likely to go through several rounds of financing, and the valuation will get higher round after round. So, it is easy to form the valuation bubble of startups, which may gradually burst after the IPOs of startups and damages investors in the primary and secondary stock markets.

The investors in the primary and secondary stock market must recognize the negative correlation between venture capital and the operating performance of startups, recognize the fact that listed companies that contain venture capital may have valuation bubbles, and carefully study the investment targets to have an objective understanding of their investment value instead of being fooled by the gorgeous appearances of venture capital. They must adhere to value orientation and invest cautiously.

(2) Use the relevant effects included in venture capital to increase investment income

The empirical analysis in this paper mainly demonstrates the adverse selection between venture capital and the operating performance of startups. And hypotheses and theories put forward in previous researches related to venture capital such as the grandstanding hypothesis, supervision hypothesis, certification hypothesis, market power hypothesis, supervisory mechanism effect and incentive mechanism effect have not been verified here.

On the whole, these theories make sense to a certain extent, and are verified and applied a lot in practice. Investors in the stock market can use these theories including adverse selection effects to increase investment returns. For example, according to the grandstanding hypothesis, venture capitalists try to improve their reputation, so when the venture capitalists announce that they are about to sell their stocks and exit, it is likely to conduct a certain market support transaction. At this time, the secondary investors in the stock market can buy stocks and exit after gaining the spread return.

Chapter 7 Conclusions and Prospects

Now, this paper has completed the analysis of problem introduction, empirical model, causes and effects of adverse selection, and countermeasure suggestions. It is necessary to review the previous research work, summarize some of the research conclusions, and probe into the existing problems and point out the direction of future research. After that, this paper reaches its end.

7.1 Main tasks and conclusions

7.1.1 Review of main work

This paper investigates the impact of venture capital on the operating performance of startups and conducts an in-depth discussion on the problem formulation, empirical analysis, cause and effect analysis, and countermeasure suggestions. The main research work includes:

The first part is the introduction, mainly explaining the research backgrounds, reasons, purposes and significance, research content, research methodology, technical routes and possible novelties of the paper.

The second part is fundamental theories and literature review. It mainly includes concepts related to venture capital and startups, relevant theories of the impact of venture capital on the operating performance of startups, and Chinese and foreign literature reviews and evaluations.

The third part is development process of venture capital and research problems in this study. It mainly includes the development history of

Chinese and foreign venture capital, as well as the introduction to the research problems, relevant research framework and research design.

The fourth part is empirical analysis of the impact of venture capital on the operating performance of startups. It mainly includes the characterization dimension of the operating performance of startups, regression analysis of the impact of venture capital on operating performance of startups, hypothesis verification and conclusion discussion of the impact of venture capital on operating performance of startups.

The fifth part is cause and effect analysis of adverse selection in venture capital The causes for adverse selection mainly include market-based selection of risk appetite, information asymmetry, and principal-agent mechanism. Adverse selection effects mainly elaborate the possibility of increasing venture capital for startups by making use of adverse selection, lemon market, and valuation bubble, moral risks and threshold issues.

The sixth part is countermeasure analysis of the impact of venture capital on the operating performance of startups. It puts forward countermeasures and recommendations for venture capital, startups, and other participants in the capital market mainly based on the empirical analysis on mutual impact between venture capital and operating performance of startups in order to deepen the value of this paper.

The seventh part is the conclusions and prospects. It consists of the main work and conclusions of the paper are reviewed, and the problems and directions which require further study are pointed out for the paper.

7.1.2 Main conclusions and analysis

In the research process of this paper, some important conclusions have been formed, and they will be summarized and analyzed for their applications as follows.

(1) There is a negative correlation between venture capital and operating performance of startups, which mainly results from the adverse selection effect.

Adverse selection is an important phenomenon when venture capital enters a startup, and is the result of two-way selection. Venture capital tends to choose startups with poor operating performance for investment, and startups with poor operating performance also tends to seek the venture capital. So even before the IPO, the operating performance of these venture capital startups is still generally lower than that of startups without venture capital.

From the perspective of venture capital, startups with poor operating performance generally have low valuations, and they can obtain more equities at a lower capital cost. Once the IPOs of invested startups are successful, the wealth effect will be more considerable than investing in companies with good operating performance and high valuations.

Therefore, the occurrence of adverse selection is a normal market behavior.

From the perspective of startups, startups with poorer operating performance have higher desire for funds while have limited financing channels, so they more welcome venture capital. Under this driving force, more startups with poor operating performance choose to attract venture capital for financing, and even reduces valuations to some extent. As a result, the operating performance of startups with venture capital is generally lower than that of startups without venture capital. Such adverse selection is normal market behavior.

However, the startups with poor operating performance may form an interest transfer to the management team of venture capital in order to successfully attract venture capital, which means to use the principal-agent relationship between venture capital and venture capital managers to make a profit for the venture capital managers which in turn facilitates adverse selection of venture capital. This is immoral. Or in order to successfully attract venture capital, the startups with low operating performance takes advantage of the information asymmetry between the venture capital and the reserve investment companies, causing venture capital to be hoodwinked to make wrong judgments and choose the startups proved to have poor operating performance afterwards, then, this is a passive adverse selection, which seriously violates the basic principles of the market economy.

(2) The causes for adverse selection in venture capital mainly include the market selection of risk appetite, information asymmetry, and principal-agent mechanism. The adverse selection effect can increase the possibility for startups to obtain venture capital. In the meanwhile, we need to avoid the adverse selection and moral risks arising from information asymmetry and principal-agent mechanism.

Different venture capitals have different risk appetites, forming venture capitals that focus on the initial stage, early-stage, medium-stage and pre-IPO stage in the market. Due to different investment fields, different risk preferences and different investment stages, there are various types of venture capitals in the market. This is a normal behavior caused by different market positioning. Out of financing needs, startups seek venture capital to achieve success according to their own operating performance, asset characteristics, development stage, growth, etc. This is also normal market behavior.

In order to attract the attention of venture capital and successfully obtain venture capital, the startups can structurally lower the profitability, solvency, and operating capabilities of the operating performance to improve the possibility of attracting venture capital. However, startups must optimize the structure under stock conditions, make some minor adjustments to operation, finance, strategy, R&D, and market, and respond to the concerns and preferences of venture capital, rather than create a poor operating performance divorced from the actual situation,

otherwise it is likely to harm the venture capital and the startups their own.

For the adverse selection of the investment of venture capital in startups with low operating performance caused by the use of principal-agent relationship and information asymmetry, it should be prevented by venture capital and startups with all their strengths. Because it is unethical and does not conform to the principles of marketization, which contains obvious risks. In order to avoid the adverse selection and moral risks caused by the use of the principal-agent relationship, venture capital funds should strengthen institutional constraints and enhance the construction and cultivation of professional ethics. In order to avoid the adverse selection caused by information asymmetry, the venture capital fund management team must improve the professional competences. If necessary, external experts can be introduced and valuation adjustment mechanism can be utilized to reduce possible risks.

In general, this paper has also made some important conclusions in the valuation bubble, lemon market and threshold in the field of venture capital. There are also many conclusions in the countermeasures for other participants in the capital market, which will not be elaborated one by one.

7.2 Insufficiencies and future research

7.2.1 Insufficiencies

There are still some insufficiencies in the research and discussion of this study, mainly in the following two aspects:

First, there are certain research limitations. In the empirical analysis of this study, the public cross-sectional data before the IPO is mainly employed to obtain samples of venture capital and venture-free investment, and form two control groups, in order to study the impact between venture capital and the operating performance of startups. It is also the mainstream research method on this issue at home and abroad. However, such research still has certain limitations. Because for specific startups, each startup differs greatly, and it is easy to ignore the individual characteristics of startups through the research method of the control group. If going deep into a single startup and tracking enough sample cases for a sufficient amount of time, the impact between venture capital and the operating performance of startups can be observed more profoundly, and the conclusions drawn can be more convincing.

In 1938, Harvard University conducted an adult development study, planning to use 75 years to track the life of 724 males, record their work, family, state of health, and observe their life trends. Now the study has finished, and the results show that it is the good interpersonal relationship that determines one's happiness in life, rather than money, fame, fortune, and work. Such long-term continuous tracking makes the conclusion very convincing[①]. The author believes that the venture

[①] Dr. Hai Lan. (2018,February 4) *A 75 Years of Research of Harvard University Proves: What Kind of Person is the Happiest?* . http://dy.163.com/v2/article/detail/D9Q6SILQ0514DG98.html

capital will also have a life-long impact on the operating performance of startups. From follow-up research and the acquisition of time series data and individual characteristics of the control group samples of startups with and without venture capital, the research on mutual impact between venture capital and the operating performance of startups can be significantly deepened. Certainly, such condition is not available to many researchers, including the author.

In general, this study has certain research limitations, and this understanding is of positive significant to improve the subsequent research.

Second, this study fails to perform more verifications on many hypotheses and theories. In terms of the impact between venture capital and the operating performance of startups, many hypotheses and theories have been put forward in the previous research. During the early stage, this study considered that verification might be made on many hypotheses and theories through the empirical analysis of pre-IPO cross-sectional data of Chinese GEM listed companies, but finally found that only the adverse selection hypothesis can be verified and logically deducted mainly based on empirical analysis. As the author's professional experience is mainly engaged in the practical activities of venture capital, the author has a strong interest in these hypotheses and theories, and hopes to form support or denial of these hypotheses and theories through research to guide the investment practice in future. But this study fails to achieve this goal. This is also a

shortcoming of this study, and related issues deserve continuous attention and in-depth research.

7.2.2 Future research

In the author's view, the research on the impact of venture capital on the operating performance of startups has great practical significance. The shortcomings mentioned above can be further improved in the future, and the related research directions mainly include the following two aspects:

First, the follow-up study of venture capital cases can be improved. Setting venture capital or venture-free investment as a control group for group comparison and research certainly has prominent academic value and significance, but if venture capital or venture-free investment cases are selected to conduct long-term case tracking to conclude an impact relationship based on time series and individual characteristics, the conclusion will obviously deepen the value and significance of the research. The author has easy access to a large number of real-life cases due to the work. Therefore, even after this study is ended, the follow-up research on venture capital cases will be strengthened, and thereby consolidate his academic experience and ability.

Second, verification research on hypotheses and theories related to venture capital can be strengthened. Previous studies have formed many hypotheses and theories on the relationship between venture capital and the operating performance of startups, but these hypotheses and theories are mainly based on sample analysis and

practice comparison of foreign markets such as the United States. But China's venture capital market has certain particularities. First, the development time of venture capital market is relatively short. Second, the state-owned economy has a dominant position. Whether these hypotheses and theories are applicable to the China's venture capital market, whether they can be verified, and how the practical activities of venture capital will be impacted, all of which are worthy of in-depth study. In the future, the author will continue to pay close attention to and explore the verification of hypothesis and theories related to venture capital.

In short, as a senior practitioner in the field of venture capital, the author hopes to combine investment practice and academic exploration. Therefore, despite that the way of academic research is arduous and long, the author will forge ahead.

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